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AND

CHEMICAL REPERTORY.

Devoted to the Interests of Illumination, Heating, Ventilation and Sanitary Improvement, Domestic Economy, and General Science.

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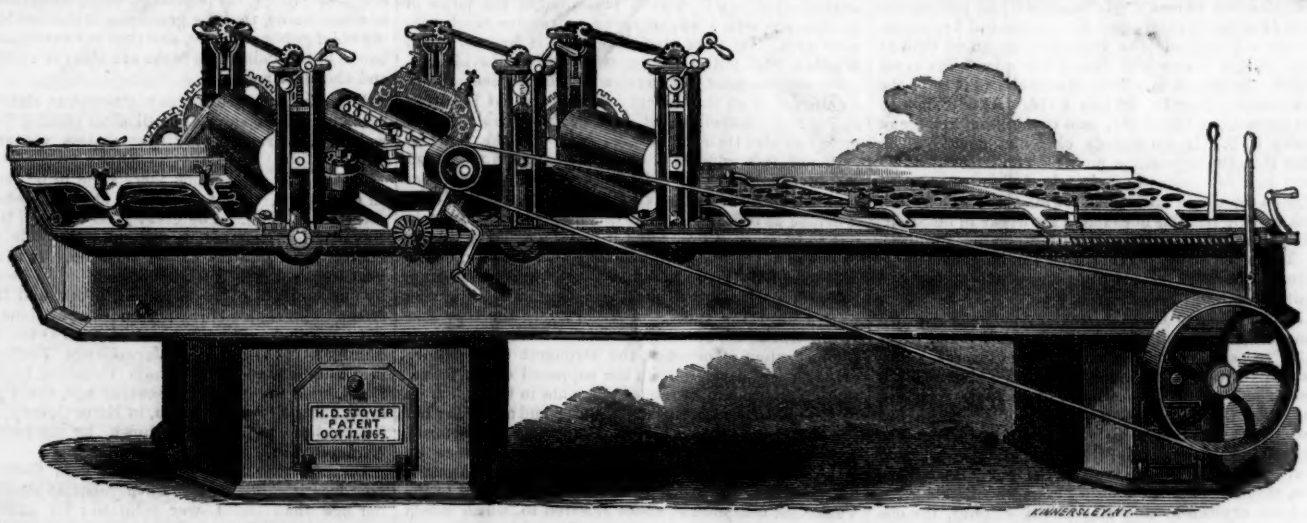
NEW YORK, MONDAY, NOVEMBER 16, 1868.

$3 PER ANNUM
IN ADVANCE.

H. D. Stover's Improved Planer and Matcher.

This is a very heavy, strong and effective machine, and in its arrangements and adaptations is superior to any of the same class in use. It has a heavy iron frame. The cylinder, which is furnished with two knives, is made of *solid wrought iron*, with steel bearings, and being made of the toughest metal, is not liable to burst or break. The cylinder raises at a right angle with the driving-shaft, by which means the length of belts is at all times the same. The dead-weight and pressure roll are combined to form a perfect security against the usual clip at the ends of the board, which, with the convex mouth-cap of the cylinder to break the chip, makes perfectly smooth work on all kinds of lumber. The patent Matcher Clip is also applied to this machine. The machine is furnished with three pairs of six and eight-inch feed rolls connected by patent expansion feed works, which admit of the most free and easy expansion of the rolls at all times. The boxes of the cylinders, matcher, and counter-shafts are of the best gun-metal, and are each supplied with oil cells to supply oil continually to the bearings. The matcher shafts are of steel, and together with the heads are made in the most substantial manner, and are connected with the rear end crank-index, giving width, by which they can be instantly adjusted to different widths of lumber without the operator leaving the rear end of the machine.



H. D. STOVER'S IMPROVED PLANER AND MATCHER.

Further information can be obtained at the office of the Stover Machine Company, No. 117 Liberty street, New-York.

Utilization of Waste Steam in Warming Buildings.

We learn from an English exchange of 24th October that the steam from high-pressure engines is led into a self-acting apparatus, patented by Messrs. Herring & Co., of Chertsey, and is there condensed and utilized in warming the buildings, after which it is returned to the boiler still hot, and so pure, from its previous distillation into steam, that it can produce no incrustation in the boiler. Not only are the buildings connected with the steam power thus warmed, but 95 per cent. of the water is thus economized in its re-use, and fuel saved by the re-entrance of the water while still hot into the boiler. By this apparatus 20,000 cubic feet of mill or manufactory per horse-power, it is said, can be warmed, and six gallons of water per horse-power per hour saved, the water, as we have indicated, giving a hot feed, and without deposit; and all this continues to be done absolutely without any cost, the only outlay being the first cost of the apparatus, which seems to be safe as well as economical. The using up of waste heat has for many years received our attention, and we do not recollect of a finer example of such utilization than this at least in theory; and as for the practice, it seems that this invention has been tested, with great success, by the experience of the two last winter seasons.

A New English Gas Stove.

A patent of H. Pedge, says the *Builder*, dated 23d January, 1868, claims, first, so fitting or constructing gas-stoves in which air is employed to convey the heat, that the products of combustion and heated air therewith are prevented from mixing with the air in the apartment or place to be heated when the air to support combustion and to be heated is wholly or nearly altogether supplied from the open air, or from some source outside the said apartment or place to be heated or warmed. Secondly, so fitting or constructing gas-stoves in which water or other liquid, or both water or other liquid and air, is or are the agent or agents to convey the heat that the products of combustion and heated air therewith are prevented from mixing with the air in the apartment or place to be heated, when the air to support combustion and to be heated is wholly or nearly altogether supplied from the open air, or from some source outside the said apartment or place to be heated or warmed. Thirdly, the particular constructions and arrangements of parts of the two several gas stoves for heating purposes, all as described and illustrated in the drawings.

—Prof. H. Dussauce, Chemist, met with an accident recently, severely hurting his left arm.

Chemical Repertory.

November 16th, 1868.

Under this head it is my purpose to lay the foundation of what, I trust, may grow in time into a most important, if not the leading, department of this Journal.

Time will be a necessary element in the erection of this, as of any edifice intended to be substantial and enduring. I hope to enlist the assistance of American chemists. This may be an ambitious hope, but time will show.

I shall most cheerfully offer explanations and reply to questions on chemical points, addressed to me at this office; and I solicit all such.

HENRY WURTZ.

4. USES AND ABUSES OF ANALOGY.

ALLOTROPIC FORMS OF METALLIC ARSENIC.

BY A. BETTENDORFF.

The following interesting and important facts, which are taken from a Memoir published a year since, in the *Annalen der Chemie und Pharmacie*, have not, to my knowledge, been laid before American readers.

Upon the sublimation of pure metallic arsenic in a quick current of hydrogen gas, there is deposited in the neighborhood of the heated point, metallic hexagonal arsenic, somewhat further on black amorphous arsenic, whilst the whole of the rest of the tube is filled with a clear yellow vapor, that quickly deposits, becoming dark yellow, and finally gray. This *gray* powder was proved to be the metal arsenic by oxidation with nitric acid to arsenic acid, yielding its equivalent of the latter. It was wholly amorphous, and consisted of globules strung to one another in a bead-like manner, exactly like freshly prepared flowers of sulphur. Density at 14° C., 4.71. At about 360° it suddenly passes, with an evolution of heat strong enough to sublime a portion, into crystalline arsenic of density 5.72. The *yellow* powder, which cannot be preserved permanently, passing into the gray condition, constitutes probably another special modification. Amorphous arsenic may be obtained as a black vitreous material by passing the vapor of arsenic, volatilized in a current of hydrogen, through a U-shaped tube immersed in an oil-bath at 220°. Slight blows will detach the mirror-like crust formed. Synthesis into arsenic acid shows it to be the pure metal. Density, 4.71 to 4.716. At 360° it likewise passes, as the above, into crystalline arsenic of density 5.72. It withstands chemical agents much better than the crystalline metal. The latter loses its lustre in a few hours in moist air, and is very easily oxidated by dilute nitric acid; whilst the amorphous black arsenic remains unchanged for weeks in moist air, and is attacked by nitric acid with much more difficulty. There can be little doubt that the familiar arsenic mirrors of MARSH's test are composed of this amorphous modification.

[It thus appears that the analogy between the two elements, arsenic and phosphorus, is remarkably exact in this respect. Each has a crystalline form, more or less easily attacked by the oxygen of the air and other agents; and an amorphous form, of comparatively difficult oxidation. Tempting subjects of speculation at once offer themselves here. Are we to find in the case of every elementary body, that these two opposite chemical conditions, the active and the passive modifications, may inhere? In another group of the elements we have crystalline and amorphous sulphur, the one soluble, the other insoluble in bisulphide of carbon, and having other antithetical relations; oxygen and ozone; and other similar cases. The most special question that occurs; and one pertinent to the immediate subject; is, whether we are not to look for and expect to discover these two opposite conditions in the other members of the elementary group which forms pentacids, to which arsenic and phosphorus belong; namely, nitrogen, antimony, and bismuth (to which we are now in all probability to add, according to the recent elegant researches of ROSCOE,* the-as-yet unknown element vanadium.

Particularly interesting is this question regarding one of these, namely, *nitrogen*. Is the highly passive and indifferent form of this which exists in the atmosphere, only one of two possible antithetical states, and are we yet to look for *active* nitrogen, corresponding to *ozone?* So little has it been regarded as in accordance with general chemical analogies, that an element playing so exceedingly important a part in nature, should become wholly inert and indifferent when in its isolate condition, that this very question has already been matter of speculation and controversy among the most profound and acute thinkers of the chemical world. Two of these, STERRY HUNT, and Prof. SCHAEFFER of Washington, have lately laid claim to the beautiful suggestion, that atmospheric nitrogen has a *double atom*, being a *residue*, so to speak, of the separation of three equivalents of water from the constituent molecule of *nitrate of ammonia*.

$NH_3, NO_3 = 3HO + NN$ (passive atmosph'c nitrogen).

The writer does not bring this up in order to join in, or revive, the controversy regarding priority in this conception. Both these gentlemen we are proud to rank among the first of American chemists, and the most grateful belief will be that the idea was conveyed to each of them independently while engaged in the same train of thought and investigation; an old, old story now in the ranks of the devoted men who battle without ceasing with the mystic forces of Nature.

The question being connected intimately with the subjects of nitrification and the origin of most important and essential portions of the pabulum of vegetable (and therefore of animal and human existence), is invested with the highest interest, and will be referred to again, more than once, in these columns. It is one of those many questions which, appearing to the general public as remote, recondite, and even insoluble, and always *unpractical*, and merely as one of the playthings of the "grown-up children" of Science; are foreseen by the latter (if true children of their inspired parent) to contain the germs of grand discoveries, conferring upon man new powers to control the elements of the Earth, subject them to the rule of intellect, and convert them to the uses of his race; of which discoveries, when made, the same public which disdains the whole matter now, as one of mere speculation, will joyfully and eagerly grasp, and apply to practical uses in those arts upon which the perpetuation of the race depends. Some of the arts involved, in this case, so far as can be discerned in advance, are those of Agriculture, Military Defence, and Mining, the most fundamental promoters and sustainers of civilization; the two latter arts being involved as dependent upon the production and control of explosive agents; in the storing and retaining of whose pent-up energies, this element nitrogen finds one of the most important occupations imposed upon it by its Creator.

The observations of BETTENDORFF, which have furnished a text for these remarks, confer upon this subject renewed interest, inasmuch as they involve a new *analogy* leading us in the same direction as the hypothesis of HUNT and SCHAEFFER. Without them, the analogical support thereto presented in the forms of phosphorus would scarce occur, or receive much consideration. Its force now, however, is far more than doubled. Still with regard to such analogical evidences, great caution must be excercised. Nothing seems more significant of an Omniscient and Omnipotent Intellect, ruling and controlling not only the perishable dust of men, but also their immortal souls; than the consideration of this important element in human reasoning and investigation called *Analogy*. It seems a *snare* set purposely for the Inductive Philosopher. As often does it delude as otherwise. The Chemist is especially subject to be mocked by it; and it may be asserted that in chemical investigations the amount of analogy, or the number of distinct analogies, must be *overwhelming*, before hypothesis can be safely considered as having passed into the sphere of *Theory*. In the very case above discussed, of the hypothesis of the atmospheric coupled atom of nitrogen, the strongest confirmatory evidence was derived from the supposed direct formation of nitrite and nitrate of ammonia in the soil from their atmospheric constituents, water and nitrogen; but this has been since controverted by several chemists, and strongly impugned on experimental evidence by MEISSNER. (More of this, though, hereafter.) Another illustration is furnished by ROSCOE's new view of the Vanadium compounds, above referred to, which would seem based upon analogies so irrestible; but upon which some recent suggestions of RAMMELSBERG have thrown a shadow of doubt which will only be removed by the isolation of ROSCOE's hypothetical Vanadium (which, it would seem, should not be so difficult a matter, if it has an existence). RAMMELSBERG'S* remarks have much more force, when considered in connection with DEBRAY's discussion of the constitution of *molybdic acid*,† showing, from the vapor-density of molybdic chloride, that the acid, well-known to form an isomorphous group with vanadic and tungstic acids, must have the formula MO_3.

Still, without analogy, but little progress would be made in discovery. Most hypotheses are founded at first upon it; and those who decry the use of hypothesis in investigation would put an effectual drag upon the wheels of Science herself. The very term so rifely used in connection with such phenomena as those which BETTENDORFF has here examined, *allotropism*, introduced by the great BERZELIUS, involves hypotheses, but has had its uses, and those important ones, in the advancement of Science. A man groping his way out in the dark, from a labyrinth or an unknown cave, will follow this natural and inevitable law of the human mind; of commencing by *guesswork*, if we choose to call it so, He will grope in this direction or in that, until he finds a passage, and will follow such passage unto the day, or until most probably it proves a *cul de sac;* and then return and try another path. He thus at least gains the advantage of ascertaining which way not to go. The mind of man holds a similar relation to the labyrinth of Nature. He must seek out and discover the clues to the creative thoughts of the Divine mind by the same process. There is a tradition that the Soul of NEWTON, when about to be launched on the Ocean of Eternity, whence "the white arms" beckon to us all; glassed to him his past career as that of a child that had been engaged in fitful and frantic quest for pebbles on the storm-vext beach.—H. W.]

* *Philosophical Magazine*, April, 1868, p. 307; also in abstract in the *Chemisches Centralblatt*, Sept. 9, 1868, p. 650.

* *Chemisches Centralblatt*, Sept. 9, 1868, page 652.
† *Comptes Rendus*, April, 1868, page 732.

5. STAT PRO RATIONE VOLUNTAS.

MURCHISON's new edition of Siluria has been announced as issued for some time, though we have not yet been favored with a sight of the work itself. Doubting not that the whole taken together must be magnificent and masterly, as befits the author's antecedents, the writer must still be allowed to demur earnestly to the general conclusions under one important head: the *Distribution and Origin of Gold;* this being a subject to which he has himself given special study and attention, and on which he feels authorized, therefore, to write controversially, even against so illustrious an opponent. The conclusions are found quoted in the last issue of HEATHERINGTON's valuable Nova Scotia *Mining Gazette*, with an allusion to the wide and obvious divergences from the published views of the writer of this, presented to the American Association in 1866, which have been republished in full by HEATHERINGTON,* and are as follows:

"1. That looking to the world at large, the auriferous vein-stones in the Lower Silurian rocks contain the greatest quantity of gold.

"2. That where certain igneous eruptions penetrated the secondary deposits, the latter have been rendered auriferous for a limited distance only beyond the junction of the two rocks.

"3. That the general axiom before insisted on remains, that all secondary and tertiary deposits (except the auriferous detritus in the latter) not so specially affected" [by '*igneous eruptions*' I suppose.—H. W.] "never contain gold.

"4. That as no unaltered purely aqueous sediment ever contains gold, the argument in favor of the igneous origin of that metal is prodigiously strengthened; or, in other words, that the granites and diorites have been the chief gold producers, and that the auriferous quartz bands in the Palæozoic rocks are also the result of heat and chemical agency."

Deferring, as is meet, any attempt at elaborate discussion of these subjects until after reading the whole work, a few remarks are nevertheless ventured upon now.

To the first proposition there seem to be such marked exceptions, that it is difficult at the present day to entertain it at all. The great gold range of the Sierra Nevada, for example, is without reasonable doubt of far *later* age than the Lower Silurian. It is now four years since it was settled, *independently of each other*, by our eminent palæontologist, MEEK, and Mr. GABB, of the California Survey; from examinations of "fossils, from the auriferous slates, collected at the Mariposa estate," that these were of *Jurassic* age Further north, in Tuolumne and El Dorado Counties, fossils were found, with the gold, of an earlier age, the *Upper Triassic*, and still further north, in Butte County, the auriferous slates were clearly shown, by the fossils, to be *Carboniferous*.

On the other hand, established gold fields are not now wanting, resting also upon *fossil* evidence, of earlier age than the Lower Silurian; for example, the new one in Hastings County, Canada, usually called the "Madoc region"; in the Lower Laurentian, or Eozoic. The schists of Scandinavia, which have been proved to be auriferous in many places, are also believed to be of Eozoic age. In fact, it will be found to be now an accepted conclusion, among those best informed, that *gold is of no special geological age;* according wholly with the writer's theory of Gold-Genesis, promulgated in 1866; which traces the origin of gold back to the waters of the Prozoic or Primeval Ocean, the precious metal having been held in solution therein by *persulphate of iron*, by virtue of an appreciable solvent action of the latter on metallic gold; a fact which was discovered by him and published as long ago as 1858; and which clearly and simply explains, moreover, the formation of auriferous pyrites by the reducing action of organic matters upon the auriferous persulphate of iron of the ocean (an action coincident with the birth of Life); besides making plain many other things heretofore deemed as almost inscrutable mysteries.

The attempt by MURCHISON, still to perpetuate the plutonic hypothesis of the derivation of gold solely from eruptive rocks, and the impregnation of veins

*Also in the *American Journal of Mining*, Vol. iv, pp. 274, 322, 339, 354, and 370; Vol. v, pp. 18, 60, 114, 130, and 242.

therewith by *igneous* agencies the writer thinks also will receive support at this day from few such geologists as look upon these questions from a chemical point of view. At the recent Chicago meeting of the American Association, a discussion occurred upon the subject, which has been widely reported, and which strongly illustrates the tendency of students of chemical geology to maintain a deposition of the gold in veins *from solution;* though the special hypothesis which seems to have received most attention there (the *mineral spring* origin of quartz-veins and their contained gold and sulphurets,) seems in many respects inconsistent with the phenomena, and insufficient. This must be left, however, to a future article.

The occasional occurrence of eruptive masses and dikes; both of those which are probably, and those which are very doubtfully "igneous"; in crystalline schists containing auriferous beds and veins, may, in the writer's view, be reasonably regarded as *concomitant local* effects of the same intense chemical agencies which effected the wider and more uniform metamorphic changes, to which are to be attributed the segregation of the *soluble* metallic and other contents from the mass, and their collection and concentration in fissures, forming metalliferous veins. Even if it be maintained that the eruptive masses are altogether of foreign and exotic origin, and even that the *heat* which effected the metamorphic changes throughout the mass was altogether derived from them, it is not apparent how this alone invalidates, or affects in any way the above proposition, or makes it necessary to suppose that the gold and sulphurets came also from the intruded rocks.—H. W.]

CHEMICAL *EXCERPTA.*

Under this head I purpose to gather in the most *condensed* form practicable, from such recent scientific journals, both at home and abroad, as come under my eyes; the substance of such articles as seem deserving thereof. In this work, I shall not, as might be thought, hold myself confined to novel facts alone; regarding new hypotheses, and even speculations, when involving labor and ingenuity in the *generalization* of facts, as even more valuable to Science. It is hardly necessary to add that in my own comments, to which a degree of personal responsibility attaches, a less condensed style than in the abstracts themselves will be inevitable.

HENRY WURTZ.

[*Chemical News* for Oct. 2, 1868—No. 461.

DAVID FORBES, F.R.S., describes a simply constructed glass-tipped tongs or forceps, convenient for laboratory manipulations in acids, etc. He cuts off the tips of a pair of strong surgical forceps, and solders on elastic slit brass cylinders, through which pieces of glass rod slide. These latter are flattened at their tips after softening in the flame. All chemists of ordinary ingenuity and skill have and can make multitudes of such contrivances without special instruction. To such items as this we can mete out but scant allowance of space.

MUSPRATT gives an analysis of the "Old Sulphur Well" at Harrogate. He finds in an Imperial gallon (= 70,000 grains) about 862.5 grains Na Cl, 5 grains BaCl, 16.5 of *sulphide of sodium*, 25.5 cubic inches of CO^2 gas, 7 c. i. of HS gas, with traces of SrCl, LiCl, iodine, bromine, and ammonia. The other constituents are of no particular interest. The water comes from a peat bog, and is perfectly transparent at first, though smelling strongly of HS. He does not state the reaction with test papers, though it must of course be strongly alkaline. HOFFMANN, in 1854, analysed the same water. It now contains more MgO, BaCl and sulphide of sodium than then, and 12 grains more solid matter per gallon. The water is "stimulating, aperient, resolvent and alterative," and recommended particularly in complaints of the liver.—H. W.

Next is given in full Prof. GEO. J. BRUSH'S article on his new mineral, *Sussexite*, which will be found in the Sept. number of the *American Journal of Science*, and hence need not be copied by us. This interesting new mineral was discovered by our eminent mineralogist, at Mine Hill, Franklin Furnace, Sussex Co., N. J.; the famous locality of red zinc ore, franklinite and other zinc minerals. Sussexite is a *hydrous borate of manganous oxide and magnesia*, and may be represented by (MnO, MgO) $2\,BO^3 + HO$. BRUSH, however, believes the HO to be also basic. It is asbestiform in appearance.

LUDWIG MOND gave to the British Association an important communication on a new industry which is rapidly growing up in Great Britain, the recovery of sulphur from alkali-waste. So far as practical application goes, this subject is, at this day, of no direct or immediate import to American chemists; and in point of fact, the market price of sulphur in Great Britain, in the form in which it is chiefly employed, that of *pyrites* in the sulphuric acid manufacture, is so very low, that very likely no great *profit* can arise even there from the reconversion of the sulphur. It happens, however, that considerations are involved of far more importance even than profit. In crowded districts like those in which the British Alkali-Works are located, the waste becomes a wholly intolerable *nuisance*. FRANKLAND stated with relation to this subject, that he had seen a river "which, in consequence of the drainage liquor from the surrounding waste heaps meeting there with hydrochloric acid, which also ran from the Alkali-Works, was almost saturated with sulphuretted hydrogen, and gave off the dreadful smell of this noxious gas for miles." Parallel statements, quite as remarkable, were made by others on the same occasion. MOND'S method furnishes a striking example of the leading importance, in all Industrial Chemistry, next to correct fundamental *theory*, of skill and ingenuity in mastering and simplifying points of practical detail. MOND admits that no new principle has been introduced especially by himself, but that, like GOSSAGE and others before him, he operates by first effecting the oxidation of the calcic sulphide in the waste, and leaching out the soluble hyposulphite and other calcic salts thus formed; but practical success followed only upon the adoption by him, among other devices, of those of forcing air through the waste to oxidate it, and of then lixiviating, all *in the same vessels* in which the waste had been originally obtained.

MOND'S plans may have an application on this side the Atlantic in connection with the utilization, or at least the disposal, in such way as to obviate unpleasant consequences of the *effete lime of our Gas-Works*. This point is reserved, however, for future consideration. H. W.

Dr. LETHEBY'S lectures before the Society of Arts on FOOD, an installment of which comes next, are interesting and instructive in the highest degree. If space allows, some extracts will be made from this voluminous mass of material; but as many of the series have already been placed before the public in other publications, we must pass them by. Such serial papers of importance as are hereafter met with, will receive their fitting share of attention.

Mr. CROOKES has received from some London makers a sample of "India rubber sponge," which he considers a valuable novelty. We have had something very similar, if not the very thing, for similar uses, for a number of years in this country. The extreme cheapness, at present, of ordinary sponges of fair quality, has probably retarded its extensive employment.

A PROPOSAL AND A PROMISE.

The writer may propose, but the printer will dispose. Our condensed summary of Scientific Intelligence, brought down, not without care and pains, to the latest period practicable; has, for the most part, been crowded out. The period is hoped for, when the writer's scheme of bringing before the readers of this JOURNAL the full volume of the current of thought and discovery in the world of Science, may be reduced to realization.

In the last issue an important item was given, on the subject of European examinations into the scientific points involved in the uses of Petroleum and the *residuum* from its distillation, in enriching Gas. Arrangements are now in progress which authorize the statement that an opportunity will occur for further examinations into this subject. The article on the Editorial page will serve as explanation. In the next issue, more will probably be heard from this quarter. H. W.

Engraving by Electricity.—An apparatus for engraving by electricity, exhibited in the machinery department of the French Exhibition is ingenious, and illustrates the activity of mind now devoted to the improvement of the engraver's art, by the introduction of new scientific methods. A metal plate, with some object drawn upon it with a special ink, is slowly rotated with its face vertical: and several other similar plates, but of decreasing smallness, and with correspondingly diminished speed, are also slowly rotated by appropriate mechanism. On these plates it is intended the object delineated on the first plate shall be engraved on different scales of magnitude; and this is accomplished by applying a diamond cutting-point to the face of each plate, which is pressed against it through the agency of an electrical current whenever a blunt point presented to the first plate encounters the ink, but is withdrawn at other times. The point presented to the first plate is a feeler, which determines by electrical agency whether there is ink beneath it or not, and if there is, the diamond points opposite to all the other plates are pressed in, and if there is not, they are withdrawn and prevented from cutting. The feeler and the diamond burins must, it is clear, all follow a spiral track.—*Trade Journal.*

On the Inflammability of Mineral Oils.

In a recent communication to *Dingler's Polytechnic Journal*, Dr. Robert Peltzer describes a series of experiments made by him on the inflammability of different products of the distillation of Pennsylvania petroleum and bituminous schists from Auturo, in France. Some of the results of these experiments are tabulated below:

Distilled petroleum,	0.643,	inflames at	5 8° Fah.
" "	.686	"	5.8 "
" "	.740	"	*59. "
" "	.748	"	60.8 "
" "	.750	"	62.6 "
" "	.760	"	95. "
" "	.775	"	113. "
" "	.783	"	122. "
" "	.792	"	167. "
" "	.805	"	194. "
" "	.822	"	230. "
" "	.831	"	203. "
" "	.848	"	158. "
" "	.850	"	136.4 "
Crude petroleum	.802	"	59. "
Heavy oils left in retort		"	343.4 "
Solid paraffin		"	429.8 "

Each product was heated in a small capsule over a water or paraffin bath, a thermometer being inserted in the liquid, and a thin burning wick held over the same. The oils experimented upon were differently obtained; some were drawn directly from the cooling worms in refineries; others were prepared by fractional distillation in small retorts; and others were procured by the evaporation of specifically light mixtures.

The first two samples, characterized by the specific gravities 0.643 and 0.686, both took fire at the extremely low temperature of 5.8° Fah. With the samples following the inflammability diminishes until the density of 0.822 is reached, *but from this point it increases.* This remarkable fact is easily explained when we consider that the high temperature which is necessary to distil the oils of 0.822 is sufficient to produce a partial decomposition of the higher boiling oils in the retort. In producing a light oil of 0.8, distillers generally collect only the portions which come over up to this point; the first fractions which are used with the illuminating oil possess a specific weight of 0.750; the mixture does not then take fire below 96.8° F.

The remainder in the retort may be heated to 343·4 F. before it is influenced by a burning wick. When, however, after the distillate had reached the specific weight of 0.822, the heat was increased, as it always is increased for the production of lubricating oils, the inflammability also increased, as is seen from the foregoing table.

Refined paraffin, of a melting point of 129·2° Fahr. could be heated to 429.8° F. It then took fire, but without a prior decomposition being noticed, which obviously had taken place in the distillation of the heavy oils and crude oil-containing paraffin masses.

The samples of schist oil experimented on were obtained by distillation on a small scale. They were found to be much more inflammable than the oils from petroleum of corresponding densities.

Upon the decomposition of the petroleum oils at a high temperature, Dr. Peltzer believes that a process might be devised for converting the heavy oils into more valuable illuminating oils. With the heavy peat oils Mr. Breitenlohner, of Chlumetz, Bohemia, has successfully carried out such a process.

For making the crude petroleum applicable and perfectly safe for the heating of steam boilers, it would be necessary to separate all the oils until the density of 0.783 is reached, and then to free it from the absorbed gases. Though oils may yet be present which are inflammable at from 122° to 167° F., their percentage is so small that the fluid will bear a heat of 176° to 212° F. without there being any danger of explosion. The oils below the density of 0.783 could be sold partly as ordinary lamp oils and partly as spirit for sponge-lamps.—*Ironmonger, London, Oct.* 31.

Liquid Fuel Combustion.—We learn through the columns of an exchange that the Patent Fuel Company, at Depford, England, burn liquid fuel, or creosote, by a patent process in tar boiling. The liquid is pumped from a reservoir by a small force pump into a boiler, till a pressure is obtained of twenty-five pounds to the square inch, which enables it to be injected with considerable force into the furnace, where the steam is generated. The feed from the boiler, when the pressure is raised, takes place through a small wrought iron gas-pipe, having one coil near the surface of the grate, from which the creosote escapes at a temperature of about 670 deg. to 700 deg. Fahrenheit, through four apertures, each about one-sixteenth of an inch in diameter. The productive power of thirty-six gallons, costing 3s., was equivalent to eight to ten hundred weight of coal, while the relative volume was only two fifths that of the coal.

Chemical Repertory.

November 16th, 1868.

Under this head it is my purpose to lay the foundation of what, I trust, may grow in time into a most important, if not the leading, department of this Journal.

Time will be a necessary element in the erection of this, as of any edifice intended to be substantial and enduring. I hope to enlist the assistance of American chemists. This may be an ambitious hope, but time will show.

I shall most cheerfully offer explanations and reply to questions on chemical points, addressed to me at this office; and I solicit all such.

HENRY WURTZ.

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BY A. BETTENDORFF.

The following interesting and important facts, which are taken from a Memoir published a year since, in the *Annalen der Chemie und Pharmacie*, have not, to my knowledge, been laid before American readers.

Upon the sublimation of pure metallic arsenic in a quick current of hydrogen gas, there is deposited in the neighborhood of the heated point, metallic hexagonal arsenic, somewhat further on black amorphous arsenic, whilst the whole of the rest of the tube is filled with a clear yellow vapor, that quickly deposits, becoming dark yellow, and finally gray. This *gray* powder was proved to be the metal arsenic by oxidation with nitric acid to arsenic acid, yielding its equivalent of the latter. It was wholly amorphous, and consisted of globules strung to one another in a bead-like manner, exactly like freshly prepared flowers of sulphur. Density at 14° C., 4.71. At about 360° it suddenly passes, with an evolution of heat strong enough to sublime a portion, into crystalline arsenic of density 5.72. The *yellow* powder, which cannot be preserved permanently, passing into the gray condition, constitutes probably another special modification. Amorphous arsenic may be obtained as a black vitreous material by passing the vapor of arsenic, volatilized in a current of hydrogen, through a U-shaped tube immersed in an oil-bath at 220°. Slight blows will detach the mirror-like crust formed. Synthesis into arsenic acid shows it to be the pure metal. Density, 4.71 to 4.716. At 360° it likewise passes, as the above, into crystalline arsenic of density 5.72. It withstands chemical agents much better than the crystalline metal. The latter loses its lustre in a few hours in moist air, and is very easily oxidated by dilute nitric acid; whilst the amorphous black arsenic remains unchanged for weeks in moist air, and is attacked by nitric acid with much more difficulty. There can be little doubt that the familiar arsenic mirrors of MARSH's test are composed of this amorphous modification.

[It thus appears that the analogy between the two elements, arsenic and phosphorus, is remarkably exact in this respect. Each has a crystalline form, more or less easily attacked by the oxygen of the air and other agents; and an amorphous form, of comparatively difficult oxidation. Tempting subjects of speculation at once offer themselves here. Are we to find in the case of every elementary body, that these two opposite chemical conditions, the active and the passive modifications, may inhere? In another group of the elements we have crystalline and amorphous sulphur, the one soluble, the other insoluble in bisulphide of carbon, and having other antithetical relations; oxygen and ozone; and other similar cases. The most special question that occurs; and one pertinent to the immediate subject; is, whether we are not to look for and expect to discover these two opposite conditions in the other members of the elementary group which forms pentacids, to which arsenic and phosphorus belong; namely, nitrogen, antimony, and bismuth (to which we are now in all probability to add, according to the recent elegant researches of ROSCOE,* the-as-yet unknown element vanadium.

Particularly interesting is this question regarding one of these, namely, *nitrogen*. Is the highly passive and indifferent form of this which exists in the atmosphere, only one of two possible antithetical states, and are we yet to look for *active* nitrogen, corresponding to *ozone*? So little has it been regarded as in accordance with general chemical analogies, that an element playing so exceedingly important a part in nature, should become wholly inert and indifferent when in its isolate condition, that this very question has already been matter of speculation and controversy among the most profound and acute thinkers of the chemical world. Two of these, STERRY HUNT, and Prof. SCHAEFFER of Washington, have lately laid claim to the beautiful suggestion, that atmospheric nitrogen has a *double atom*, being a *residue*, so to speak, of the separation of three equivalents of water from the constituent molecule of *nitrate of ammonia*.

$NH_3, NO_3 = 3HO + NN$ (passive atmosph'c nitrogen).

The writer does not bring this up in order to join in, or revive, the controversy regarding priority in this conception. Both these gentlemen we are proud to rank among the first of American chemists, and the most grateful belief will be that the idea was conveyed to each of them independently while engaged in the same train of thought and investigation; an old, old story now in the ranks of the devoted men who battle without ceasing with the mystic forces of Nature.

The question being connected intimately with the subjects of nitrification and the origin of most important and essential portions of the pabulum of vegetable (and therefore of animal and human existence), is invested with the highest interest, and will be referred to again, more than once, in these columns. It is one of those many questions which, appearing to the general public as remote, recondite, and even insoluble, and always *unpractical*, and merely as one of the playthings of the "grown-up children" of Science; are foreseen by the latter (if true children of their inspired parent) to contain the germs of grand discoveries, conferring upon man new powers to control the elements of the Earth, subject them to the rule of intellect, and convert them to the uses of his race; of which discoveries, when made, the same public which disdains the whole matter now, as one of mere speculation, will joyfully and eagerly grasp, and apply to practical uses in those arts upon which the perpetuation of the race depends. Some of the arts involved, in this case, so far as can be discerned in advance, are those of Agriculture, Military Defence, and Mining, the most fundamental promoters and sustainers of civilization; the two latter arts being involved as dependent upon the production and control of explosive agents; in the storing and retaining of whose pent-up energies, this element nitrogen finds one of the most important occupations imposed upon it by its Creator.

The observations of BETTENDORFF, which have furnished a text for these remarks, confer upon this subject renewed interest, inasmuch as they involve a new *analogy* leading us in the same direction as the hypothesis of HUNT and SCHAEFFER. Without them, the analogical support thereto presented in the forms of phosphorus would scarce occur, or receive much consideration. Its force now, however, is far more than doubled. Still with regard to such analogical evidences, great caution must be excercised. Nothing seems more significant of an Omniscient and Omnipotent Intellect, ruling and controlling not only the perishable dust of men, but also their immortal souls; than the consideration of this important element in human reasoning and investigation called *Analogy*. It seems a *snare* set purposely for the Inductive Philosopher. As often does it delude as otherwise. The Chemist is especially subject to be mocked by it; and it may be asserted that in chemical investigations the amount of analogy, or the number of distinct analogies, must be *overwhelming*, before hypothesis can be safely considered as having passed into the sphere of *Theory*. In the very case above discussed, of the hypothesis of the atmospheric coupled atom of nitrogen, the strongest confirmatory evidence was derived from the supposed direct formation of nitrite and nitrate of ammonia in the soil from their atmospheric constituents, water and nitrogen; but this has been since controverted by several chemists, and strongly impugned on experimental evidence by MEISSNER. (More of this, though, hereafter.) Another illustration is furnished by ROSCOE's new view of the Vanadium compounds, above referred to, which would seem based upon analogies so irrestible; but upon which some recent suggestions of RAMMELSBERG have thrown a shadow of doubt which will only be removed by the isolation of ROSCOE's hypothetical Vanadium (which, it would seem, should not be so difficult a matter, if it has an existence). RAMMELSBERG's* remarks have much more force, when considered in connection with DEBRAY's discussion of the constitution of *molybdic acid*,† showing, from the vapor-density of molybdic chloride, that the acid, well-known to form an isomorphous group with vanadic and tungstic acids, must have the formula MO_3.

Still, without analogy, but little progress would be made in discovery. Most hypotheses are founded at first upon it; and those who decry the use of hypothesis in investigation would put an effectual drag upon the wheels of Science herself. The very term so rifely used in connection with such phenomena as those which BETTENDORFF has here examined, *allotropism*, introduced by the great BERZELIUS, involves hypotheses, but has had its uses, and those important ones, in the advancement of Science. A man groping his way out in the dark, from a labyrinth or an unknown cave, will follow this natural and inevitable law of the human mind; of commencing by *guesswork*, if we choose to call it so. He will grope in this direction or in that, until he finds a passage, and will follow such passage unto the day, or until most probably it proves a *cul de sac*; and then return and try another path. He thus at least gains the advantage of ascertaining which way not to go. The mind of man holds a similar relation to the labyrinth of Nature. He must seek out and discover the clues to the creative thoughts of the Divine mind by the same process. There is a tradition that the Soul of NEWTON, when about to be launched on the Ocean of Eternity, whence "the white arms" beckon to us all; glanced to him his past career as that of a child that had been engaged in fitful and frantic quest for pebbles on the storm-vext beach.—H. W.]

* *Philosophical Magazine*, April, 1868, p. 307; also in abstract in the *Chemisches Centralblatt*, Sept. 9, 1868, p. 650.

* *Chemisches Centralblatt*, Sept. 9, 1868, page 632.
† *Comptes Rendus*, April, 1868, page 732.

5. STAT PRO RATIONE VOLUNTAS.

MURCHISON's new edition of Siluria has been announced as issued for some time, though we have not yet been favored with a sight of the work itself. Doubting not that the whole taken together must be magnificent and masterly, as befits the author's antecedents, the writer must still be allowed to demur earnestly to the general conclusions under one important head: the *Distribution and Origin of Gold*; this being a subject to which he has himself given special study and attention, and on which he feels authorized, therefore, to write controversially, even against so illustrious an opponent. The conclusions are found quoted in the last issue of HEATHERINGTON's valuable Nova Scotia *Mining Gazette*, with an allusion to the wide and obvious divergences from the published views of the writer of this, presented to the American Association in 1866, which have been republished in full by HEATHERINGTON,* and are as follows:

"1. That looking to the world at large, the auriferous vein-stones in the Lower Silurian rocks contain the greatest quantity of gold.

"2. That where certain igneous eruptions penetrated the secondary deposits, the latter have been rendered auriferous for a limited distance only beyond the junction of the two rocks.

"3. That the general axiom before insisted on remains, that all secondary and tertiary deposits (except the auriferous detritus in the latter) not so specially affected" [by '*igneous eruptions*' I suppose.—H. W.] "never contain gold.

"4. That as no unaltered purely aqueous sediment ever contains gold, the argument in favor of the igneous origin of that metal is prodigiously strengthened; or, in other words, that the granites and diorites have been the chief gold producers, and that the auriferous quartz bands in the Palaeozoic rocks are also the result of heat and chemical agency."

Deferring, as is meet, any attempt at elaborate discussion of these subjects until after reading the whole work, a few remarks are nevertheless ventured upon now.

To the first proposition there seem to be such marked exceptions, that it is difficult at the present day to entertain it at all. The great gold range of the Sierra Nevada, for example, is without reasonable doubt of far *later* age than the Lower Silurian. It is now four years since it was settled, *independently of each other*, by our eminent palaeontologist, MEEK, and Mr. GABB, of the California Survey; from examinations of "fossils, from the auriferous slates, collected at the Mariposa estate," that these were of *Jurassic* age Further north, in Tuolumne and El Dorado Counties, fossils were found, with the gold, of an earlier age, the *Upper Triassic*, and still further north, in Butte County, the auriferous slates were clearly shown, by the fossils, to be *Carboniferous*.

On the other hand, established gold fields are not now wanting, resting also upon *fossil* evidence, of earlier age than the Lower Silurian; for example, the new one in Hastings County, Canada, usually called the "Madoc region"; in the Lower Laurentian, or Eozoic. The schists of Scandinavia, which have been proved to be auriferous in many places, are also believed to be of Eozoic age. In fact, it will be found to be now an accepted conclusion, among those best informed, that *gold is of no special geological age*; according wholly with the writer's theory of Gold-Genesis, promulgated in 1866; which traces the origin of gold back to the waters of the Prozoic or Primeval Ocean, the precious metal having been held in solution therein by *persulphate of iron*, by virtue of an appreciable solvent action of the latter on metallic gold; a fact which was discovered by him and published as long ago as 1858; and which clearly and simply explains, moreover, the formation of auriferous pyrites by the reducing action of organic matters upon the auriferous persulphate of iron of the ocean (an action coincident with the birth of Life); besides making plain many other things heretofore deemed as almost inscrutable mysteries.

The attempt by MURCHISON, still to perpetuate the plutonic hypothesis of the derivation of gold solely from eruptive rocks, and the impregnation of veins

*Also in the *American Journal of Mining*, Vol. iv, pp. 274, 322, 339, 354, and 370; Vol. v, pp. 18, 50, 114, 180, and 242.

therewith by *igneous* agencies the writer thinks also will receive support at this day from few such geologists as look upon these questions from a chemical point of view. At the recent Chicago meeting of the American Association, a discussion occurred upon the subject, which has been widely reported, and which strongly illustrates the tendency of students of chemical geology to maintain a deposition of the gold in veins *from solution;* though the special hypothesis which seems to have received most attention there (the *mineral spring* origin of quartz-veins and their contained gold and sulphurets,) seems in many respects inconsistent with the phenomena, and insufficient. This must be left, however, to a future article.

The occasional occurrence of eruptive masses and dikes; both of those which are probably, and those which are very doubtfully "igneous"; in crystalline schists containing auriferous beds and veins, may, in the writer's view, be reasonably regarded as *concomitant local* effects of the same intense chemical agencies which effected the wider and more uniform metamorphic changes, to which are to be attributed the segregation of the *soluble* metallic and other contents from the mass, and their collection and concentration in fissures, forming metalliferous veins. Even if it be maintained that the eruptive masses are altogether of foreign and exotic origin, and even that the *heat* which effected the metamorphic changes throughout the mass was altogether derived from them, it is not apparent how this alone invalidates, or affects in any way the above proposition, or makes it necessary to suppose that the gold and sulphurets came also from the intruded rocks.—H. W.]

CHEMICAL *EXCERPTA.*

Under this head I purpose to gather in the most *condensed* form practicable, from such recent scientific journals, both at home and abroad, as come under my eyes; the substance of such articles as seem deserving thereof. In this work, I shall not, as might be thought, hold myself confined to novel facts alone; regarding new hypotheses, and even speculations, when involving labor and ingenuity in the *generalization* of facts, as even more valuable to Science. It is hardly necessary to add that in my own comments, to which a degree of personal responsibility attaches, a less condensed style than in the abstracts themselves will be inevitable.

HENRY WURTZ.

[*Chemical News* for Oct. 2, 1868—No. 461.

DAVID FORBES, F.R.S., describes a simply constructed glass-tipped tongs or forceps, convenient for laboratory manipulations in acids, etc. He cuts off the tips of a pair of strong surgical forceps, and solders on elastic slit brass cylinders, through which pieces of glass rod slide. These latter are flattened at their tips after softening in the flame. All chemists of ordinary ingenuity and skill have and can make multitudes of such contrivances without special instruction. To such items as this we can mete out but scant allowance of space.

MUSPRATT gives an analysis of the "Old Sulphur Well" at Harrogate. He finds in an Imperial gallon (= 70,000 grains) about 862.5 grains Na Cl, 5 grains BaCl, 16.5 of *sulphide of sodium*, 25.5 cubic inches of CO^2 gas, 7 c. i. of HS gas, with traces of SrCl, LiCl, iodine, bromine, and ammonia. The other constituents are of no particular interest. The water comes from a peat bog, and is perfectly transparent at first, though smelling strongly of HS. He does not state the reaction with test papers, though it must of course be strongly alkaline. HOFFMANN, in 1854, analysed the same water. It now contains more MgO, BaCl and sulphide of sodium than then, and 12 grains more solid matter per gallon. The water is "stimulating, aperient, resolvent and alterative," and recommended particularly in complaints of the liver.—H. W.

Next is given in full Prof. GEO. J. BRUSH's article on his new mineral, *Sussexite*, which will be found in the Sept. number of the *American Journal of Science*, and hence need not be copied by us. This interesting new mineral was discovered by our eminent mineralogist, at Mine Hill, Franklin Furnace, Sussex Co., N. J.; the famous locality of red zinc ore, franklinite and other zinc minerals. Sussexite is a *hydrous borate of manganous ozide and magnesia*, and may be represented by (MnO, MgO) $2\,BO^3 + HO$. BRUSH, however, believes the HO to be also basic. It is asbestiform in appearance.

LUDWIG MOND gave to the British Association an important communication on a new industry which is rapidly growing up in Great Britain, the recovery of sulphur from alkali-waste. So far as practical application goes, this subject is, at this day, of no direct or immediate import to American chemists; and in point of fact, the market price of sulphur in Great Britain, in the form in which it is chiefly employed, that of *pyrites* in the sulphuric acid manufacture, is so very low, that very likely no great *profit* can arise even there from the reconversion of the sulphur. It happens, however, that considerations are involved of far more importance even than profit. In crowded districts like those in which the British Alkali-Works are located, the waste becomes a wholly intolerable *nuisance*. FRANKLAND stated with relation to this subject, that he had seen a river "which, in consequence of the drainage liquor from the surrounding waste heaps meeting there with hydrochloric acid, which also ran from the Alkali-Works, was almost saturated with sulphuretted hydrogen, and gave off the dreadful smell of this noxious gas for miles." Parallel statements, quite as remarkable, were made by others on the same occasion. MOND's method furnishes a striking example of the leading importance, in all Industrial Chemistry, next to correct fundamental *theory*, of skill and ingenuity in mastering and simplifying points of practical detail. MOND admits that no new principle has been introduced especially by himself, but that, like GOSSAGE and others before him, he operates by first effecting the oxidation of the calcic sulphide in the waste, and leaching out the soluble hyposulphite and other calcic salts thus formed; but practical success followed only upon the adoption by him, among other devices, of those of forcing air through the waste to oxidate it, and of then lixiviating, all *in the same vessels* in which the waste had been originally obtained.

MOND's plans may have an application on this side the Atlantic in connection with the utilization, or at least the disposal, in such way as to obviate unpleasant consequences of the *effete lime of our Gas-Works*. This point is reserved, however, for future consideration. H. W.

Dr. LETHEBY's lectures before the Society of Arts on FOOD, an installment of which comes next, are interesting and instructive in the highest degree. If space allows, some extracts will be made from this voluminous mass of material; but as many of the series have already been placed before the public in other publications, we must pass them by. Such serial papers of importance as are hereafter met with, will receive their fitting share of attention.

Mr. CROOKES has received from some London makers a sample of "India rubber sponge," which he considers a valuable novelty. We have had something very similar, if not the very thing, for similar uses, for a number of years in this country. The extreme cheapness, at present, of ordinary sponges of fair quality, has probably retarded its extensive employment.

A PROPOSAL AND A PROMISE.

The writer may propose, but the printer will dispose. Our condensed summary of Scientific Intelligence, brought down, not without care and pains, to the latest period practicable; has, for the most part, been crowded out. The period is hoped for, when the writer's scheme of bringing before the readers of this JOURNAL the full volume of the current of thought and discovery in the world of Science, may be reduced to realization.

In the last issue an important item was given, on the subject of European examinations into the scientific points involved in the uses of Petroleum and the *residuum* from its distillation, in enriching Gas. Arrangements are now in progress which authorize the statement that an opportunity will occur for further examinations into this subject. The article on the Editorial page will serve as explanation. In the next issue, more will probably be heard from this quarter. H. W.

Engraving by Electricity.—An apparatus for engraving by electricity, exhibited in the machinery department of the French Exhibition is ingenious, and illustrates the activity of mind now devoted to the improvement of the engraver's art, by the introduction of new scientific methods. A metal plate, with some object drawn upon it with a special ink, is slowly rotated with its face vertical: and several other similar plates, but of decreasing smallness, and with correspondingly diminished speed, are also slowly rotated by appropriate mechanism. On these plates it is intended the object delineated on the first plate shall be engraved on different scales of magnitude; and this is accomplished by applying a diamond cutting-point to the face of each plate, which is pressed against it through the agency of an electrical current whenever a blunt point presented to the first plate encounters the ink, but is withdrawn at other times. The point presented to the first plate is a feeler, which determines by electrical agency whether there is ink beneath it or not, and if there is, the diamond points opposite to all the other plates are pressed in, and if there is not, they are withdrawn and prevented from cutting. The feeler and the diamond burins must, it is clear, all follow a spiral track.—*Trade Journal.*

On the Inflammability of Mineral Oils.

In a recent communication to *Dingler's Polytechnic Journal*, Dr. Robert Peltzer describes a series of experiments made by him on the inflammability of different products of the distillation of Pennsylvania petroleum and bituminous schists from Auturo, in France. Some of the results of these experiments are tabulated below:

Distilled petroleum,	0.643,	inflames at	58°	Fah.
" "	.686	"	5.8	"
" "	.740	"	*59.	"
" "	.748	"	60.8	"
" "	.750	"	62.6	"
" "	.760	"	95.	"
" "	.775	"	113.	"
" "	.783	"	122.	"
" "	.792	"	167.	"
" "	.805	"	194.	"
" "	.822	"	230.	"
" "	.831	"	203.	"
" "	.848	"	158.	"
" "	.850	"	136.4	"
Crude petroleum	.802	"	59.	"
Heavy oils left in retort		"	343.4	"
Solid paraffin		"	429.8	"

Each product was heated in a small capsule over a water or paraffin bath, a thermometer being inserted in the liquid, and a thin burning wick held over the same. The oils experimented upon were differently obtained; some were drawn directly from the cooling worms in refineries; others were prepared by fractional distillation in small retorts; and others were procured by the evaporation of specifically light mixtures.

The first two samples, characterized by the specific gravities 0.643 and 0.686, both took fire at the extremely low temperature of 5.8° Fah. With the samples following the inflammability diminishes until the density of 0.822 is reached, *but from this point it increases.* This remarkable fact is easily explained when we consider that the high temperature which is necessary to distil the oils of 0.822 is sufficient to produce a partial decomposition of the higher boiling oils in the retort. In producing a light oil of 0.8, distillers generally collect only the portions which come over up to this point; the first fractions which are used with the illuminating oil possess a specific weight of 0.750; the mixture does not then take fire below 96.8° F.

The remainder in the retort may be heated to 343·4 F. before it is influenced by a burning wick. When, however, after the distillate had reached the specific weight of 0.822, the heat was increased, as it always is increased for the production of lubricating oils, the inflammability also increased, as is seen from the foregoing table.

Refined paraffin, of a melting point of 129·2° Fahr. could be heated to 429.8° F. It then took fire, but without a prior decomposition being noticed, which obviously had taken place in the distillation of the heavy oils and crude oil containing paraffin masses.

The samples of schist oil experimented on were obtained by distillation on a small scale. They were found to be much more inflammable than the oils from petroleum of corresponding densities.

Upon the decomposition of the petroleum oils at a high temperature, Dr. Peltzer believes that a process might be devised for converting the heavy oils into more valuable illuminating oils. With the heavy peat oils Mr. Breitenlohner, of Chlumetz, Bohemia, has successfully carried out such a process.

For making the crude petroleum applicable and perfectly safe for the heating of steam boilers, it would be necessary to separate all the oils until the density of 0.783 is reached, and then to free it from the absorbed gases. Though oils may yet be present which are inflammable at from 122° to 167° F., their percentage is so small that the fluid will bear a heat of 176° to 212° F. without there being any danger of explosion. The oils below the density of 0.783 could be sold partly as ordinary lamp oils and partly as spirit for sponge-lamps.—*Ironmonger, London, Oct.* 31.

Liquid Fuel Combustion.—We learn through the columns of an exchange that the Patent Fuel Company, at Depford, England, burn liquid fuel, or creosote, by a patent process in tar boiling. The liquid is pumped from a reservoir by a small force pump into a boiler, till a pressure is obtained of twenty-five pounds to the square inch, which enables it to be injected with considerable force into the furnace, where the steam is generated. The feed from the boiler, when the pressure is raised, takes place through a small wrought iron gas-pipe, having one coil near the surface of the grate, from which the creosote escapes at a temperature of about 670 deg. to 700 deg. Fahrenheit, through four apertures, each about one-sixteenth of an inch in diameter. The productive power of thirty-six gallons, costing 3s., was equivalent to eight to ten hundred weight of coal, while the relative volume was only two fifths that of the coal.

The Application of the Regenerative Gas Furnace to Produce Cast Steel.

(From the Proceedings of the Chemical Society, London, Thursday, May 7th, 1868.)

Mr. C. W. Siemens, F.R.S., delivered a lecture on the above named topic. The lecturer announced himself to have been a pupil of Wöhler, and he was prepared to estimate highly the value of chemical science in directing the studies of the engineer and electrician. The regenerative gas furnace, which has during the last few years been applied to the manufacture of iron and glass, and is destined to play an important part in other chemical operations, is the joint invention of Mr. Frederick Siemens and the lecturer. It was described in 1862 by Professor Faraday, and formed the subject of his last public lecture in the Royal Institution. Before proceeding to enter upon the discussion of the furnace itself, and its peculiar details of construction, Mr. Siemens briefly sketched the properties and modes of preparation of cast steel. This product was defined as being a "compound of iron and carbon, possessing the remarkable property of becoming exceedingly hard when heated and suddenly cooled." The proportion of carbon determines its temper, and the following table, which was shown in the form of a diagram, indicates the average composition of steel of different qualities:

Description.	Carbon per cent.	Authority.
Wootz	1·84	T. H. Henry.
Steel for flat files	1·2	Willis.
" for turning tools	1·0	"
" (Huntsman's) for		
" cutters	1·0	"
" for cutters	0·9	"
" for chisels	0·75	"
Die steel (welding)	0·74	"
Double shear steel	0·7	"
Welding steel	0·68	"
Quarry drills	0·64	"
Mason's tools and ramrods	0·42	"
Common steel for stamping	0·42	"
Spades and hammers	0·3 to 0·32	"
Bessemer steel for rails	0·25 to 0·30	Various.
Homogeneous metal (armor plates)	0·23	Percy.
Very mild steel from open furnace	0·18	Willis.
Sample, before adding spiegeleisen	0·05	"
Bessemer iron (pure)	trace	Abel.

Steel containing 1·4 per cent. of carbon partakes of the character of white cast iron, and below 0·3 per cent. the metal is incapable of being hardened. M. Frémy's opinion, that nitrogen (or cyanogen) is a necessary component of steel, was alluded to, and the probability of other elements being essential to its constitution was guardedly asserted. The presence of sulphur and phosphorus are undoubtedly prejudicial when they occur in considerable quantities, but the lecturer considers that traces of these elements may sometimes prove advantageous by increasing the fluidity and toughness of cast steel. The use of manganese fluxes, according to Heath's patent (1839), rendered it possible to prepare good steel from ordinary qualities of English puddled iron: and Mushet's discoveries of the important advantages to be gained by the employment of ferromanganese, or spiegeleisen, had paved the way to Mr. Bessemer's later triumphs. In the opinion of the lecturer manganese has a special action in improving the quality of steel, apart from its function in removing sulphur and other impurities. Silicon, when present to the extent of 0·5 per cent., rendered it impossible to forge the ingots, but small quantities seemed, on the other hand, to be advantageous by preventing the evolution of gas in the interval between casting and solidification. The evidence respecting the effects of titanium, tin, and arsenic, was not conclusive; but Dr. Werner Siemens showed, in 1853, that tungsten had a remarkable action upon steel, in increasing its power of retaining magnetism when hardened. This property of tungsten was illustrated in his lecture-room by a small permanent magnet of horse-shoe form, which supported twenty times its own weight from the armature; the famous Haarlem magnet being incapable of lifting a weight more than thirteen times heavier than itself. The steel of which Mr. Siemens' magnet was made contained about 2 per cent. of tungsten, and 0·4 of carbon.

Reference was then made to the several processes of preparing steel, which were considered under the following heads, viz.:—The direct process in the Catalan forge; the method of cementation; the decarburization process, or that which furnishes "puddled steel;" the Bessemer process; and, lastly, other methods of producing substances, with cast iron, spiegeleisen, or other compounds containing much carbon, such as those practiced by Uchatius, Price and Nicholson, G. Brown, Attwood, and others.

Experiments on the direct production of steel by a fan blast on an open hearth, according to M. Sudre's method, were made under the supervision of M. St. Claire-Deville and two other members of the French Institute; but the rapid destruction of the furnace, combined with the great cost for fuel, rendered the process a doubtful success. The applicability of the regenerative gas furnace to the fusion of steel and other metallurgical products, was partly established by the trials of Mr. Charles Attwood, in 1862, and of M. Lechatelier a year later, at Montlucon in France; the gentl man last named melted together hot puddled blooms and cast iron upon a bed of the aluminous mineral known as bauxite, and subsequently upon a bottom formed of common white sand. Later, in 1864, MM. Emile and Pierre Martin melted steel, both in pots and on the open hearth, by the aid of the gaseous fuel of the regenerative furnace. Their products, consisting of cast steel of various qualities, were shown at the French International Exhibition, and recorded by a gold medal. With the view of making for himself a series of practical trials on the production of steel, Mr. Siemens constructed two experimental furnaces in Birmingham, and succeeded in preparing steel of good quality, not only in closed pots, but on a continuous system direct from the ore. The details of these furnaces were explained with the help of large diagrams and dissecting models, whereby the leading points of their construction were clearly demonstrated. The principle of Mr. Siemens' plan of heating is already well known; the ordinary form of regenerative furnace having, indeed been recently described by Mr. Henry Chance, who advocated its use in glass making. The fuel is heaped upon an inclined fire-grate, where it undergoes a kind of slow combustion, which results in the formation of carbonic oxide; this inflammable gas is then conducted from the "producer" to the hearth or working platform of the furnace, where it meets a current of air already raised to a high temperature, which enables it to burn with great intensity, and the excess of thermal power, instead of being allowed to pass directly into the chimney, and become thus wasted, is forced to traverse an intricate structure of brickwork, which absorbs so much of the heat, that the gaseous products of combustion rarely indicate a temperature above 300° Fahr. At a suitable stage of the operation the gas valves are reversed, and both carbonic oxide and air forced to traverse these heated brick chambers in a contrary direction, so that they may in turn become the recipients of that heat which, in ordinary constructions of furnaces, would have been lost. The ashes and clinkers are in this way entirely separated from the region of manipulation, and are removed from the grate at intervals of one or two days. The composition of the inflammable gas varies with the nature of the fuel and the draught of the furnace; by way of illustration, Mr. Siemens quoted the following, as representing an average result for the gas from the producers at the St. Gobain plate glass works, where caking coal is employed in admixture with one-fourth of a non-caking quality:

Carbonic oxide	24·2
Hydrogen	8·2
Carburetted hydrogen	2·2
Carbonic acid	4·2
Nitrogen	61·2
	100·0

Besides the above, there are always present aqueous vapor, tarry matters, and small proportions of sooty and earthy particles. The author estimates the temperature of the gas as it rises from the fuel at 1000 to 1300° Fahr., but it becomes considerably hotter in its passage to the area of combustion beneath the crown of the furnace. An ingenious electric resistance pyrometer, with platinum helix, which has done good service in measuring these elevated temperatures, was exhibited; and an experiment was performed in the lecture-room, for the purpose of demonstrating the principle of the "regenerators," lead being melted in the reversed current of hot air blown through a heated stack of flints previously ignited over a Bunsen burner. The special furnace, which serves for the direct production of steel, has a tunnel head, or cylindrical hopper, fed with iron ore and small coke passing through, and raised above, the crown of the regenerative gas furnace; the lower part of this upright cylinder rests in a bath of molten pig-iron, which dissolves the reduced (spongy) iron as quickly as it is separated from the ore. A blast-pipe descends through the stack of ore, and the process is interrupted when the steel is ready for casting, after which the charge of pig must be renewed.

In the case of using bar iron (worn out rail) in the preparation of steel, they were introduced into an inclined hopper with their lower ends resting in a bath containing 10 per cent. (by weight) of molted pig; and the atmosphere of the furnace might be changed at will into an oxidizing, reducing, or perfectly neutral condition, merely by altering the proportion of air and gas. It is important to keep the carbon at a minimum, for then the silicon is lowest.

The lecture was amply illustrated by a series of diagrams showing the construction of the several kinds of regenerative furnaces in plan and section, and a large model of a gas producer was upon the table. The following specimens were also exhibited:

Cast steel produced by melting Bessemer scrap in Siemens' furnace.

Cast steel produced by melting iron rail ends from Hayange, France, containing nearly 1 per cent. of phosphorus.—Siemens' furnace.

Magnet steel containing tungsten.—Pot furnace

Steel made in open furnace from Staffordshire iron Carbon, 0·37 per cent.

Steel from puddled iron from Creusot.—Open furnace. Carbon, 0·38 per cent.

Ingot of steel made in open furnace from red and cold short metal. Carbon, 0·4 per cent.

The same metal tilted.

Steel made from Bessemer scrap in open furnace, containing 0·46 per cent. of carbon.

The president, having proposed a vote of thanks to the lecturer, took occasion to remark that the regenerating furnace offered special facilities for making experiments upon steel, with the view of ascertaining the effects of different adventitious substances. The statement of the wonderful magnetic properties of tungsten steel surpassed all that the Dutch had accomplished, and it would now be interesting to study the influence of boron.—*Chemical News.*

Terrific Explosion in an English Coal Pit.

[*From the London Times, Oct. 2.*]

On Wednesday morning last one of the most terrific accidents that has ever happened in this locality occurred at the Green Pit, belonging to the New British Iron Company, near Ruabon, in which ten men were killed and fifteen injured. The cause of this appalling accident was an explosion of gas, which occurred a little after 11 o'clock, and the effect of which was not only severely felt all over the workings, but also at a distance of two miles. It was also felt and heard at Ruabon, as also some distance on the Llangollen line of railway, and at other places of equal distance from the scene of the explosion. It shook the very foundation of Plasmadoc, the residence of Mr. Whalley, and greatly frightened the inmates. The floor in the vicinity of the mouth of the shaft was torn up, and fully testified to the great force of the explosion. The No. 1 shaft was, of course, blocked up for some time; Mr. Ralph Darlington, underground manager of the pits, and Mr. Robert Taylor, underlooker of the No. 2 pit, were the first who descended the No. 2 shaft after the explosion. Dr. Burton, with Mr. T. Lloyd Evans, arrived at the scene of the accident in twenty minutes after it occurred, and shortly afterwards Dr. Burton, with Mr. Evans, the manager of the New British Iron Company, and Mr. Pepplewell, engineer, descended the pit for the purpose of ascertaining the number of dead and wounded, and to make arrangements for those who were only injured to be brought up first. There was, of course, great difficulty in finding all who were killed, owing to the rubbish beneath which some of them were buried. The excitement in the pit was so great after the accident that the men from all points rushed to the pit's mouth, and were the first to be drawn to the bank. The men were afterwards wound up, and immediately upon their arrival at the bank they were attended to by Dr. Burton and his assistant, and conveyed home in carts which were ordered for the purpose. As soon as the accident became known the scene of excitement throughout the neighborhood was intense, and half frantic women and children were to be seen running from all directions to the pit, where the excitement was increased by seeing some of their relatives or friends brought up either dead or injured. Six of the dead bodies and all the injured men and boys were wound up the No. 2 pit, and those who were killed were placed in the lamp-room, and were soon identified. They were soon afterwards taken to their houses in conveyances. The remaining four dead bodies were drawn up the No. 2 pit and placed in carts in readiness. The scene of restoring the injured, some of whom seemed in a very lifeless state, was one of the most exciting character; and in a few instances it required a good deal of time to bring some of them round.

Oxygen Gas from Atmospheric Air.—A new method has been devised by A. Mallet of preparing oxygen gas from atmospheric air. Subchloride of copper absorbs this gas from the air and is changed into an oxychloride, which, when heated to 400 deg. Cent. gives off its oxygen, and is reconverted into the subchloride. He places this copper salt in an horizontal retort, which can be rotated and mixed in sand or clay to prevent its melting together. A gentle heat is applied to the rotating vessel and the gas collected. One kilogramme of chloride furnishes twenty-eight to thirty litres of oxygen. A stream of air is then passed through the retort and in three hours its contents can again be heated.—*London Artizan.*

The New York Society of Practical Engineering.

[REPORTED FOR THE AMERICAN GAS-LIGHT JOURNAL.]

A regular meeting of the Society was held on Tuesday evening, October 27th. The president, James A. Whitney, presiding.

The regular paper related to "Sewers and Sewerage Systems," and a paper on this subject, prepared by Mr. J. P. Kirk, of New York City, was read by Joseph B. Lyman, Corresponding Secretary.

The writer described the sewerage systems of Paris and London as consisting of not only the ordinary surface drains, but also large sub-drains or sub-sewers constructed below and at right angles to the former; these sub-cellars were very large, and some of them many miles long, the upper drains emptying their contents into them, such contents being conveyed beyond the boundaries of the city, where it was partly used for fertilizing purposes, and the remainder discharged into the rivers. He thought that the sub-sewer system could be adopted, with some modifications, to the sub-drainage of the low-lying districts of the city of New York, and that it ought to be done. He stated that there were over two hundred miles of sewers built in the city of New York, but as they had been built as they were needed, and streets were opened, there was no system in their arrangement, and for the reason that there had been no authority given nor means provided to reconstruct the old sewers upon an improved system. If this sub-sewer system were adopted the low-lying portions of the city, such as the Harlem flats, etc., could be kept dry, which would be of very great advantage in a sanitary point of view, and greatly increase the value of the property in the neighborhood.

Dr. A. P. Ytterre mentioned that he had personally visited the Paris sewers, and had found the ventilation so perfect that no foul odor could be perceived therein.

Dr. A. W. Holl said that he could hardly favor the idea embraced in the sub-sewer plan of receiving the contents of the sewer in reservoir sewers below the others and below the level of the tide, and thence pumping it up to such height that it may flow away. A better plan would be to employ the engines to pump water into elevated reservoirs, so that under a high head it might be let into the sewers as at present constructed, and wash them out at low tide. He also objected incidentally to the use of sewerage for manurial purposes, stating that vegetables were frequently most offensively tainted when grown on ground prepared with such fertilizers.

C. Williams—Such a plan might answer where the sewers were situated above high tide, but where they are below, the sub-sewer system will be found essential. The same system should also be adopted in draining the low lands in the vicinity of New York.

J. Harrison—It is only a short time since I witnessed some laborers cleaning a sewer at the corner of Canal and Thompson streets, and was surprised to find that at high tide the water rises to within twenty-four inches of the surface of the streets. I was told that in the basements on either side the moisture at such times could be scraped from the walls. When the tide rises it passes into the sewers and forces their contents back into them; there is no way of preventing this except by a low system of drainage, as in the sub-sewer plan, and excluding the river wholly from the sewers. The sewerage could, further, by this means be utilized for fertilizing purposes if thus collected, than by any present means.

Wm B. Harrison.—The common sewage is worth but three or four cents a ton, but when the manurial matter is separated by chemical means it may be of great value. I agree with Dr. Hall in regard to what he says concerning vegetables grown in soil rank with manure of this character. I have seen molasses made from sorghum thus grown that was quite unfit for use from the odor pervading it.

Joseph B. Lyman.—I am unwilling that any impression should go forth from this society against the utility of sewage for manure. The best writers and agriculturists of the time are agreed as to the value of such materials for fertilizing purposes. The injurious results mentioned were caused simply for the want of properly preparing the manure. It is the evident design of the laws of Nature that organic and minerel debris should neutralize each other. By combining the refuse of vegetable and animal organizations with suitable mineral substances their ammoniacal matter is fixed, and they are thus adapted to the wants of plants. The strongest animal manures may be rendered completely inodorous by mixing them with swamp-muck. The sewers of our cities are continually carrying into the rivers the fertility of our soil, just as the Cloaca of Rome emptied into the Tiber that of the fields from whence her supplies were drawn, until Sicily and Italy in which, in the time of Cæsar, bounteous crops of wheat were raised, are now comparatively barren.

J. Harrison.—To return to the construction of sewers. At present when the tide recedes and leaves the sewers it leaves behind it a thick deposit of sand and heavy matter, which it is very difficult to remove between the intervals of high-tide; at the same time the soluble and fertilizing materials are carried away by the water; both of these results would be obviated by the sub-sewer plan.

A Member.—The objections mentioned are not the only ones incident to the present plan. When the tide enters the sewers it forces back the noxious gases through the traps and contaminates the atmosphere therewith.

Mr. Capen suggested that the sewerage could be carried into large tanks passed through materials to absorb the fertilizing constituents and thence discharged by pumps.

After some further discussion, which drew out a variety of views more or less connected with the subject in hand, the Society adjourned with the announcement that at the next meeting the subject of "Railway Accidents and the Means of Preventing Them," would be taken up for discussion.

Manufacture of Artificial Diamonds.

The French publication, *La Propagation Industrielle*, publishes a description of M. Caliste Saix's method of producing colorless, colored or black diamonds. The system is based on a principle that when a current of chlorine or of hydrchloric gas passes through cast iron in a liquid state, perchloride or protochloride of iron is formed, both of which vaporize, the carbon contained in the cast iron remaining in both cases perfectly intact, because the chlorine cannot directly unite with it. The crystallization of the carbon is then within the general rule, for in a body which is dissolved and capable of crystallization, crystallization takes place each time that the dissolving agent evaporates, the size of the crystal depending always on the slowness of the operation. 1st. To obtain colorless diamonds a current of dry chlorine must be brought to the bottom of the crucible containing the cast iron by means of a bent tube of china or fire-clay. No organic coloring matter resists the action of chlorine, so that the perchloride of iron in evaporating leaves the carbon to become a colorless crystal. 2d. When it is desired to give the crystal a blue, pink, or yellow tint, it is only necessary to mix with the cast iron certain metallic oxides in sufficient quantity such as those of chromium, cobalt and others, or their salts, which will give these colors. 3d. To obtain black diamonds, hydrochloric gas must be brought to the bottom of the crucible in the same manner as for colored or colorless diamonds. Protochloride of iron will be formed, which is volatile, but in this case the carbon will remain black, in consequence of the presence of hydrogen. This explains the fact of all diamonds having the same chemical and mineral properties, and why in nature the black diamond is found in the greatest quantity, because its formation in alluvial soils requires only the presence of sulphuric acid and marine salt, whereas the others require the presence of particular oxides which are often wanting. To obtain all these varieties of diamonds special furnaces are not necessary; the crucibles must be covered to prevent the oxidation of the cast iron which might change the carbon into carbonic oxide, and diminish, in consequence, the yield of the operation; these crucibles should be provided with a small tube, reaching outside the furnace, which will enable the chlorides resulting from the reaction to be gathered. When the liquid cast iron has been almost completely evaporated out of the crucibles, the diamonds can be removed without disturbing the crucibles, and by means of solvents any cast iron which might be adhering to them can be removed; the operation of cutting will thus be shortened, for there will be no more oxidized particles to remove, and the crucible will be ready for a fresh operation. According to M. de Saix one kilogramme of cast iron will yield at least sixty grammes of diamonds. The cost price of the colorless diamonds will be about twenty francs per sixty grammes, which, at the current price, would be 85,009 francs. The cost of the black diamonds will be under five francs per sixty grammes, representing a value of 14,200 francs.

Charcoal Filters.—The employment of charcoal filters has long been advocated, on account of the known property of this substance to absorb and oxidize organic matter. Mr. W. Skey, of New Zealand, has now shown that charcoal will remove arsenic from water. If a few drops of a solution of a salt of arsenic, or arsenious acid, be put into a few ounces of dilute sulphuric acid, and the mixed solution agitated at intervals with recently ignited charcoal for an hour or two, the clear liquid obtained by filtration does not manifest any reaction of arsenic when tested by Marsh's process. Tungstic acid also is removed from acid solutions by charcoal applied in like manner, and is given up to a solution of caustic alkali.

Foreign Gas Items.

At the usual meeting of the Metropolitan Board of Works, Mr. Newton moved the following resolution:—

"That in the opinion of the Board it is expedient that the manufacture of gas should, as far as practicable, be removed from the populous districts of the metropolis; that the Board should promote a bill empowering them to supply gas to the metropolis; that if it be desirable to take the existing gas companies they should be compensated, the terms of such compensation to be, if possible, agreed on between the Board and the companies; and that the matter be referred to the special gas committee, with instructions to obtain the needful advice and take the necessary steps for the preparation of Parliamentary notices and of a bill to be introduced into Parliament during the next session; these powers, however, not to be sought if the companies will agree on such a price and such regulations as to the supply of gas as shall be satisfactory to Parliament."

Mr. Evans moved an amendment—

"That in the opinion of the Board it is not advisable to take measures to promote a bill in Parliament in relation to gas supply during the ensuing session of Parliament."

After a long discussion the amendment of Mr. Evans was carried upon a division.

The Sheffield Gas Company have declared a dividend at the rate of ten per cent. for the last year, at their annual meeting.

Bombay cathedral is now lighted with gas. The sparrows that frequent the place found the burners very convenient to build their nests in, and when on the first two Sundays the gas was fully turned on, the materials composing these nests ignited, and there were, for a few minutes, three or four small conflagrations, that for a time looked dangerous, more especially as several sparks fell into the pews immediately under the burners.

At the half yearly meeting of the shareholders of the Geelong Gas Company, a dividend of 10 per cent. per annum was declared. The consulting engineer's report enumerated considerable improvements in plant and erection of masonry, and stated that the works were in a complete state of repair.—*London Builder.*

Petroleum—Pennsylvania and California.

At the recent meeting of the National Academy of Sciences, says a San Francisco paper, Prof. Whitney read a paper by Prof. Peckham, giving his idea of the source of both the Pennsylvania and California petroleums. He considers the latter of animal origin, and not, like the former, the product of the decomposition of woody fiber, or of the natural distillation of shales and soft coal. He says:

"The small amount of nitrogen present in the Pennsylvania oils does not make their origin from plants impossible; but when one comes to the later oils of California, so much nitrogen is present as to render the decomposition of the petroleum analogous to putrefaction of animal flesh. Theoretical formulæ, showing how stearic acid, and the stearate and oleate of glycerine might easily be changed in the oils or hydrocarbons, were presented. Profein, when subjected to decomposition, submerged in water, would give rise to a nitrohydrocarbon like the California oils. At one locality in California the boring penetrated several feet through a mass of fossil bones, saturated with the fluid. The liquid retained for several days the cellular structure of bone, but finally lost its organic structure of exposure. If it be objected that a petroleum derived from animals ought to contain phosphorus and sulphur, it may be clearly shown that the aqueous conditions of decomposition will remove both the elements as soluble compounds, and scarcely any traces of them be left behind. Petroleum was hence divided into two classes: the first contains paraffine, and forms asphaltum by inspissation, or absorption of oxygen from the air; and the second contains no paraffine, and forms asphaltum by decomposition. The first are the liquids from Oil Creek, Pennsylvania, the second are well represented by the petroleums of Southern California. The latter are not held in natural reservoirs, as in Pennsylvania. The strata are tilted at every angle, and the fissures are of limited extent, so that the oil is really kept in place by capillary attraction. The wells bored there have varied from 50 to 400 feet in depth."

—M. Wurtz has succeeded in preparing by synthesis, chlor-hydrate of trimethyloxethylammonium. It is in long deliquescent needles, and is identical with the neurine usually obtained from brain matter. *L'Institut* gives an account of Mr. Wurtz's experiments.

Miners' Lamps.

Another improvement in safety lamps, the object of which is, by means of a simple contrivance, to extinguish the light should the lamp be clandestinely opened, is introduced by Mr. Louis Desens, of London. The object is effected in the following manner: The wick-holder, a small tube, has at one side a toothed rack, and is supported in another tube of larger diameter, having a rundle externally round the centre and furnished with two projections, the longest of which may be termed a tail-piece, the object of which will be mentioned hereafter. The teeth of the rack gear with a small endless screw mounted on a shaft (passing through the body of the lamp), the lower end of which terminates in a button, by means of which the wick is regulated from the bottom of the lamp. Round the holder is a spiral spring, its object being to force the holder into the body of the lamp when the teeth of the rack are freed from the endless screw as hereinafter explained. On the bottom plate supporting the glass a small movable metal piece is fixed which turns on a pivot; on one side is a stop pin, and on the other a small spring. In the gallery surrounding the opening communicating with the body of the lamp an opening is cut, forming a decline, in which the projections of the external tube engage and assist the descent of the holder into the lamp. Supposing then all the pieces *in situ* and the lamp lighted, in screwing on the top when the tail-piece of the rundle comes in contact with the projection attached to the plate supporting the glass, it pushes it on one side each time it passes, and the spring reinstates it; by this it will be seen that the wick is not interfered with; when closed the lamp is locked in the usual manner. In unscrewing the lamp the piece referred to, on coming in contact with the projection, is resisted by the latter by means of the stop pin, and turning round the rundle and tube in connection with it, disengages the rack from the screw, and the wick-holder and wick then fall into the body of the lamp, and the light is immediately extinguished.—*British Trade Journal.*

The Exports of Petroleum.

Leaving out France, which takes crude petroleum almost exclusively, most of the exports to Continental Europe consist of the refined article, which is not only safer to transport, as may be gathered from the fact that vessels carrying crude are subject to an extra insurance of three or four per cent, but is really cheaper to the foreign dealer and consumer. It was with a view to retaining the entire business of refining petroleum in this country that so strenuous an effort was made at the last session of Congress to have the tax on the refined product reduced, and which, though it met with only partial success, will, it is thought, ultimately be accomplished, since a monopoly of the refining process must necessarily add some millions of dollars annually to the wealth of the country.

As to the risks incident to the transportation of petroleum there appears to be a great diversity of opinion, though, as between crude and refined, it is obvious that the former is by far the more inflammable, and, therefore, more dangerous. Any liquid or product that will throw off explosive vapor must, to a certain extent, be dangerous to convey; but if the fear of accident were allowed to operate to the prejudice of common carriers, a severe blow would be inflicted upon commercial interests. Considering the immense commerce afforded by petroleum, the accidents directly or indirectly chargeable to the article, it must be confessed, have been proportionately small.

Petroleum and its products may be safely transported when not exposed to heat beyond a certain recognized degree, and when carried under proper regulations of packing, but if these regulations be not observed, they may become exceedingly dangerous from their liability to explode from expansion and heat. This opinion is borne out by a recent communication to the British Academy of Sciences, by M. Henri Deville, who stated that this earth product called petroleum increases in bulk by one-hundreth of its volume for every ten degrees of heat; and that if this expansion were not allowed for, explosions must take place. But as petroleum has come to be an article of universal necessity, it is safe to say that ingenuity will devise means for the safety of its transportation, storage and handling, as it has done in the case of all other extra hazardous commodities.—*N. Y. Shipping List.*

Detection of Nitrates in Waters.

BY THOMAS P. BLUNT.

The following test for the presence of nitrates in a drinking water is a little more delicate than the common one with ferrous sulphate; it depends on the reducing action exercised by sodium-amalgam on nitric acid.

It was found that when a moderately concentrated solution of nitrate of potassium was poured over an amalgam of sodium containing about half per cent of the metal, there was no evolution of hydrogen, and on pouring off the supernatant fluid after some minutes, and applying the Nessler test, a considerable quantity of ammonia was detected. A solution of pure nitrate of potassium, containing one part in 1000, was then prepared, and measured quantities were added to different portions of ½ per cent sodium-amalgam, consisting of about 200 grains each; it was then found that 20 grain measures of nitrate solution, representing 1-50th grain of the salt, gave a just perceptible coloration with the Nessler test after standing over the amalgam for about 12 hours; 40 grain measures (= 1-25th grain salt) gave a marked reaction. Several attempts have been made to adapt the above test to the estimation of small quantities of nitric acid; they have at present, however, been unsuccessful, through the impossibility of pushing the reaction to completion; it is possible, however, that a system of comparative testing analogous to that at present adopted in the case of ammonia may lead to some results. As an example of the mode of applying the test qualitatively to a drinking water, the following account is given of an actual experiment:—

To two ounces of water known to contain a trace of nitrates, was added about 100 grains of a solution of hydrate of potassium, containing 1-12th of its weight of alkali; the whole was then evaporated nearly to dryness; thus any ammonia existing in the water would be expelled. The residue was exhausted with distilled water which gave no reaction with the Nessler test, and the quantity of the solution made up to 200 grain measures, which were afterwards divided into two equal portions. One was at once tested with ferrous sulphate solution and sulphuric acid; a very faint brown coloration appeared at the point of junction of the layers of liquid, increasing considerably after a few hours.

The second portion was introduced into a carefully cleaned test-tube, with about 200 grains of half per cent sodium-amalgam; the tube was lightly corked to check diffusion of the ammonia formed as far as possible, but not so tightly as to prevent the egress of the hydrogen, which in dilute solutions of a nitrate is always evolved from the amalgam. The whole was left for about 12 hours; the liquid was then rinsed with successive portions of pure distilled water into a glass cylinder about six inches high and one inch wide, and the quantity was made up with distilled water to about 1000 grains. On adding about 15 grain measures of the Nessler test, a very strong coloration, accompanied by incipient precipitation at once appeared. It is to be remarked that the liquid must always be decanted from the amalgam before applying the Nessler test, as the presence of nascent hydrogen appears to interfere with the action of the latter.

Shrewsbury, England, Oct. 12, 1868.

Metaliferous Metals.—The perusal of the Mineral Statistics, just issued for 1867, says the London *Mining Journal*, leads to some very interesting observations. Pyrites, which were formerly used only for the extraction of the contained sulphur, are now made to yield an important quantity of copper, the Spanish pyrites alone giving 500 tons of fine copper from the quantity of ore treated in the works on the Tyne. Wolfram, again, which was formerly regarded only as a most annoying impurity in tin ore, is returned (to the Stannaries Court) as a useful product by East Pool Mine, which sold 10½ tons, of the value of £62, Barytes, the producers of which were not long since seeking in vain for a market, figures for upwards of 11,000 tons, of the value of nearly £8,000; and that which is the more gratifying is that both sulphate and carbonate have been sold. In the utilization of arsenical ores, and as the price of the article is perhaps the best indication of its appreciation, the figures are subjoined showing the prices given per ton of 21 cwts. for the past four years at East Pool: August, 1864, 10s. per ton; Aug. 1865, 12s.; August, 1866, 25s.; Aug., 1867, 53s. 6d.; March, 1868, 84s. 6d per ton. It will be noticed that since March last the price has increased more than 25 per cent, and during the past four years more than 800 per cent.

The Electric Light in France.—The employment of the electric light, both for lighthouses and vessels, is obtaining in France the serious attention it merits. Long experience in the lighthouses of La Hève having proved the excellence of the light for this purpose, it is now on the eve of being applied at Cape Gris-Nez. For vessels, the new light was first tried in Prince Napoleon's yacht, the *Prince Jerome*, and is now permanently adopted therein. Not long since it was introduced on board the *Heroine*, an iron ship of the Imperial navy, and will, in all probability, remain there; and now the French Transatlantic Company is about to apply it in its steamships. Experiments with it have just been made at Havre on board the *St. Laurent*, and they have perfectly succeeded. The Austrian Government has approved the light in a frigate, and the Russian Government is on the point of adopting it in the lighthouse of Odessa.

Manufacture of Carbonic Acid.—Two French chemists, MM. Rousseau and Piedbœy, have applied the following simple process, says the *Scientific Review*, for producing carbonic acid on a large scale: In a moderate-sized furnace a number of retorts are placed, exactly as in the preparation of coal gas. The retorts are charged with a mixture of plaster of Paris and charcoal, the latter being in sufficient quantity to absorb all the oxygen of the sulphate of lime. Sulphide of calcium is thus produced in the heated retorts, whilst carbonic acid escapes; it is conducted through water to purify it, and finally into gasometers. A current of air, passed over the hot sulphide of calcium, reconverts it into sulphate of lime, which may thus be used over again.

List of Patents.—The following patents, pertaining to gas and water, etc., have been issued from the U. S. Patent Office, for the week ending Nov. 3: Steam and water check-valve, E. H. Ashcroft, Lynn, Mass.; lighting gas, W. W. Batchelder, New York city; non-freezing hydrant, James E. Carter, Portland, Me.; water wheel, Mark J. Colbourn, Karthaus, Pa.; steam generator, J. A. Davis, Watertown, N. Y.; low-water indicator, Eliza Joyce, New York city; pump, Thomas Chambers, St. Louis, Mo.; cooking stove, H. Brown, Harlem, N. Y.; gas-regulator, Henry Giroud, Paris, France; charging gases with vapor of hydrocarbon fluid, Cyrus M. Williams, New York city.

Fodell's System of Bookkeeping.

The following subscriptions to "Fodell's System of Book-keeping for Gas-Light Companies" have been received, making in all 34:

Santa Cruz Gas Co., California.

Smedberg's "Synopsis of Gaslighting."

The following subscriptions to the above work are acknowledged, making in all 202.

Santa Cruz Gas Co., California.

Prices of Gas Coals—Nov. 16.

PROVINCIAL.

Duty, $1 25	Coarse. Gold.	Slack. Gold.
Block House	$1 75	$0 75
Gowrie	1 75	0 75
Lingan	1 75	0 75
Sydney	2 13½	0 71½
Pictou	2 13½	1 18½
Little Glace Bay	1 75	1 00
Caledonia	1 60	0 75

AMERICAN.

	Coarse. Currency.	Slack. Currency.
Westmoreland Co.	$8 50	$8 00
Despard Coal Co.	8 25	8 00
Penn	8 50	8 00
Newburgh Orrel Gas.	8 50	8 00

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" " Cannel	14 00
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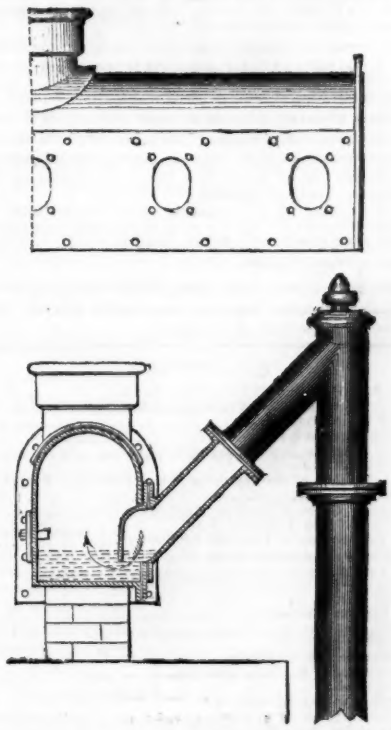

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PROFESSOR HENRY WURTZ.

[NOTE BY PROFESSOR WURTZ.—Contributions and items for which I am, as a Scientist, individually responsible, will have attached my full name or initials.—H. W.]

MONDAY, NOVEMBER 16, 1868.

WISHING TO MAKE this Journal an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of those subjects a pleasure, or a profession.

Subscribers would confer a favor upon us by remitting *CHECKS* or *POST OFFICE MONEY ORDERS*, as we are frequent losers where money is enclosed in letters.

☞ NEWS AGENCY.—The American News Company, 119 and 121 Nassau street, New York, are agents for this Journal. Newsdealers will please send orders to them.

CONTENTS

H. D. Stover's Improved Planer and Matcher 145
Utilization of Waste Steam in Warming Buildings 145
A New English Gas Stove 148
CHEMICAL REPERTORY 146
On the Inflammability of Mineral Oils 147
Liquid Fuel Combustion 147
The Application of the Regenerative Gas Furnace to Produce Cast Steel 148
Terrific Explosion of Gas in an English Coal Pit 148
Oxygen Gas from Atmospheric Air 148
New York Society of Practical Engineering 149
Manufacture of Artificial Diamonds 149
Foreign Gas Items 149
Petroleum—Pennsylvania and California 149
Miners' Lamps 150
The Exports of Petroleum 150
Detection of Nitrates in Waters 150
Metalliferous Metals 150
The Electric Light in France 150
Manufacture of Carbonic Acid 150
List of Patents 150
Fodell's System of Book-keeping 150
Smedberg's Synopsis of British Gas-Lighting 150
Prices of Gas Coals—Nov. 16th 150
Answers to Correspondents 152
EDITORIALS—
McKenzie's Process Again 152
The Olfactory Offences of the Gas Works 152
Burners for Gas 152
Editorial Items 153
Defrauding a Gas Company 153
Progress of the Chicago Tunnel 153
New Galvanic Battery 153
Miscellaneous Items 160

Answers to Correspondents.

E. P., of Mo.—You will find the information you desire in Clegg. You should by all means own a copy of this work.

G. E. C., of Md.—Gas from the retorts entering the holder will increase the pressure at the outlet owing to the friction of the holder. If the holder is nicely balanced the increased pressure will be but a trifle.

E. W. S., of Conn.—Take equal parts of white lead. oxide of manganese and pipe clay; grind thoroughly with linseed oil varnish. This is said to be an excellent cement for steam pipes.

A. P. S., of Ind.—Coal oil when manufactured by experienced parties and properly refined is a very safe illuminating agent, and quite equally so to *sperm* candles.

J. B., of N. Y.—The GAS-LIGHT JOURNAL is the proper channel through which you should advertise for a situation as manager of a gas works, as it reaches nearly all the Gas Companies both in the United States and this continent.

P. B., of Pa.—The rapid wear of iron retorts is not only due to the direct action of the gases of the furnace in oxidizing and wearing away the surface, but also to the sulphur contained in the coal combining with the iron, forming sulphuret of iron, which, being readily fused, soon melts away. The formation of graphite in the interior of a retort diminishes the conducting power of the iron, and, in order to fully decompose the coal, a higher degree of heat is necessary than would otherwise be the case, and thus the whole retort is exposed to a more intense heat than would be necessary if no deposit had been formed.

McKENZIE'S METHOD AGAIN.

The importance which this now completed and perfected invention is assuming before the American public, makes apology superfluous on our part for the prominence we now accord to it. The commanding rank held among Experts by the writer of the Report below, when considered in connection with his well known care, caution and conservatism, give to his concessions in this case a remarkable and unusual import. It may be added, that the promoters of the improvement claim (and the writer believes, from the results of his inquiries, with probable justice), that in practice the results admitted by Mr. SABBATON will be, and in fact have been already, greatly surpassed. It is promised that before the date of our next number ample means will be afforded us to test the practical and chemical questions involved to our fullest satisfaction; and to reduce the subject to such degree of precision that, to its recognized importance in a technical sense, may be added a strictly scientific value also.

H. W.

[REPORT FROM MR. SABBATON.]

OFFICE MANHATTAN GAS-LIGHT CO.,
October 8th, 1868.

MR. JOHN REID: Dear Sir—In compliance with your request I send you the result of working a sample of coal from Virginia, according to the process of Mr. McKenzie.

1st. The coal when worked by itself gave the following results. The weight of each charge being 200 lbs, and the time for carbonizing limited to 3 hours and 30 minutes.

The yield of gas, per ton of 2,240 lbs. was 10,057 cubic feet. The illuminating power being 12·10 standard candles.

The yield of coke per ton was 46 bushels weighing 1650 lbs. of good quality.

The number of feet of gas purified by one bushel of the hydrate of lime was 4457.

2d. Five per cent. of petroleum was then mixed with the coal in the manner prescribed by Mr. McKenzie; that is to say, 10 pounds of petroleum was thoroughly incorporated with 40 pounds of powdered coal, and this was intermixed with 150 pounds of clean coal, making the total weight of the charge 200 pounds. The time of distillation being the same as before, viz., 3 hours and 30 minutes.

The petroleum used in this experiment consisted of equal parts of what is commonly known as heavy oil (specific gravity 0·825) and residuum or "still bottoms" (specific gravity 0·940—water 1000).

The yield of gas was at the rate of 10,281 cub. feet per ton, and the illuminating power was 16·71 candles, determined by the standard Argand.

This experiment was repeated, substituting however, 10 pounds of residuum and heavy oils. The result showed no decrease in the illuminating power, and but little difference in the yield of gas. The former being 16·77 candles, and the latter 10,147 cubic feet to the ton.

The above experiments exhausted the sample of Virginia coal, but as I was desirous of ascertaining the *quantity* of gas evolved by the residuum when mixed with fine coal (which point could not well be determined while the gas from the respective charges was collected at a fixed period of time, i.e., at the expiration of three and a half hours) I substituted another species of coal, which with 200 pounds charges, gave as its *maximum yield* 9889 cubic feet per ton of 12·62 candle gas.

Ten pounds of residuum were then added to each succeeding charge of 200 pounds of coal, the *maximum* yield per ton being 10,449 cubic feet of 17·57 candle gas, showing a gain of illuminating power of 4·95 candles, and an increase of 560 cubic feet of gas or 5·60 cubic feet to the pound of residuum.

From the above the relative value of the Virginia coal prepared by the McKENZIE process, and that which has not been so treated, may, for the sake of illustration be stated as follows, assuming the coal to be worth $7 per ton, and the residuum one half cent per pound.

2240 lbs. coal, $7—10057 cub. ft., 12·10 candle gas.
2128 " " $7—$6.65 } 7·21—10,147 cub. ft. 16·77
112 " resd. ½ 56 } candle gas.
2240 lbs.

If, however, as Mr. McKENZIE purposes, the petroleum be mixed with "slack" coal, and this mixture used in the proportion of about thirty per cent. of the whole bulk, the cost per ton of coal thus treated will probably not exceed the cost of the coal as it now comes from the mines.

Yours very truly,
JOSEPH A. SABBATON,
Chief Eng'r Manhattan Gas Co.

THE OLFACTORY OFFENCES OF THE GAS-WORKS.

During the past summer, on the occasion of the agitation, by the respectable gentlemen who so ably manage the Metropolitan Board of Health, of the subject of the stench alleged to emanate occasionally from the purifying-houses of the Gas-Works of the Metropolis, the Manhattan Gas Company, under the inspiration of their indefatigable and indomitable President, Gen. ROOME, instituted a thorough and faithful investigation of the subject by a Board of Chemical Experts, composed of Dr. JOHN TORREY, CARL SCHULTZ, and HENRY WURTZ; with whom was called into consultation repeatedly the skilful chemical adviser of the Board, Professor CHANDLER, of Columbia College, Director of the N. Y. School o Mines. The ultimate result was a somewhat comprehensive Report upon the subject, drawn up by Prof. WURTZ; which, as we are pleased to be notified, is to be printed by the Manhattan Company during the ensuing week, in time for notice probably in our next issue. To make appreciable the importance of this announcement, we must add that in this Report is developed and laid before the world for the first time, a *most eminent improvement* in Gas Purification, now in practice by the Manhattan Co., agreed on all hands to mark a

NEW ERA IN THE ART.

BURNERS FOR GAS.

There is scarcely anything in connection with the subject of gas illumination that commands more attention than the means whereby gas may be burnt with the greatest advantage to the consumer, and although great ingenuity has been displayed in the construction of the numerous burners which have at different periods been invented, yet very few, if any, possess that universal applicability for which they have, in most cases, been commended. The reason of this is obvious: different kinds of gas require different forms of burners, in order to effect a perfect combustion. As a rule, it may be stated that the rich cannel gases are best consumed from burners with very fine apertures, while the poorer gases—those that contain less than 5 or 6 per cent. of condensable hydrocarbons—are burnt with most advantage from larger apertures.

Again, in the former case provision should be made for a large supply of atmospheric air, as by spreading out the flame by means of an internal button, or by using tall glasses; whereas, in the latter case, the very opposite should be observed. It is evident, therefore, that no single burner can be constructed as to secure both these requirements; and consequently that any burner which is well suited for one kind of gas, is altogether unfit for the other. Another important point is, that when several jets issue from the same burner, and blend together or coalesce, the light is always improved; for it is the property of one jet to assist another by elevating its temperature, and thus a greater heat and a brighter light is the result of the union.

EDITORIAL ITEMS.

☞ The *Little Corporal* for 1869 is greatly enlarged and improved by the addition of a beautifully engraved cover, and giving more reading matter than before, without raising the price. Every new subscriber for 1869, whose name and money are sent to the publisher before the end of this month, will receive the November and December numbers for 1868 free, being two months free, or fourteen numbers for $1. The *Little Corporal* is unquestionably the best magazine for the young that we have ever examined. It is published at Chicago.

☞ CHANCES FOR INVESTMENT.—We commend the attention of the readers of the Journal to the advertisement in this issue, offering for sale one of the most well-regulated and best built Gas Works in Ohio. This is an opportunity for profitable investment which should not be allowed to pass by unnoticed. The reader will observe, also, the card on page 158, which offers another opportunity to invest, with assurances of a ready return.

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DEFRAUDING A GAS COMPANY.

At the Court of Special Sessions, in this city, on the 10th ult., a German, by name Eisman Kaufman, was placed at the bar, charged with purloining gas from the Manhattan Gas-Light Company on October 31, at his place, No. 177 Bowery. The facts of the case, as developed from the statement of a witness, are, that Mr Kaufman is proprietor of a coffee saloon at the number above indicated, and it was ascertained that an india-rubber pipe was placed around the gas meter on the premises, connecting the service pipe with the pipes of the house, so that the gas would go direct frem the mains without passing through the meter. This rubber pipe was so arranged that it could be slipped off, and the regular connection with the meter easily made The Manhattan Company were represented by W. F. Howe, Esq., who in addressing the Court requested the conviction of Kaufman, and stated that the Company was victimized to a great extent by persons who, like the prisoner, were desirous of obtaining light without paying for the advantage and comfort. Justice Dowling observed that the prisoner proved a good character, and also showed that the rubber pipe was attached before he resided at the premises. The law certainly permitted the infliction of six months' imprisonment and an additional fine of $50, but under the circumstances he did not propose, in consequence of the weak nature of the case, to impose the extreme punishment. It was not proved that the prisoner was present when the offence was committed; but the Statute was plain, for it recites "that a person must not *permit* gas to be improperly used." The Justice for this reason rendered a verdict of guilty against the prisoner, but would only inflict a fine of $100. In conclusion, the Justice took occasion to announce that if any culprit was brought before him again charged with this offence he would inflict the full penalty.

PROGRESS OF THE CHICAGO TUNNEL.

The *Chicago Journal* of 22d October informs us that the east half of the tunnel is entirely completed, from the west line of Franklin street to a point near the middle of the river, where the entrance of water is prevented by a strong bulkhead. The workmen are now busy making the changes in the coffer dam necessary to opening a channel on the east side of the river, while the coffer-dam is being built on the west side of the river to carry forward the remaining portion of the work. It is expected that within the next twenty-four hours the present dam will be removed and the channel of the river changed, so that vessels will pass through on the east side.

On the west side of the river the tunnel is completed to within 70 feet of the river bank, thus leaving only about 130 feet of the work to be accomplished. With anything approximating good weather, the work can and will be entirely finished by the close of the present year—thus giving the city an opportunity of celebrating the opening of this great enterprise on New Year's Day of 1869. It is evident that the tunnel will afford safe and ample room for all pedestrians and vehicles that may pass through it. The wagon way is large enough for the largest loaded teams to pass each other without collision, and the compartment for pedestrians is sufficient to accommodate the largest throng of people who may chance to make the trip at one and the same time. The entire length of the tunnel is 1,605 feet. The covered portion is 920 feet in extent, and there are three avenues under the river—two for teams and one for pedestrians. Some idea of the magnitude of the work may be formed from a knowledge of the amount of material used. By the time the tunnel is completed, the contractors will have used 4,000,000 of brick, 25,000 barrels of cement, 15,000 cubic yards of sand, 8,000 cubic yards of dimension stone, 6,000 cubic yards of "rip rap," and 14,000 yards of "rubble."

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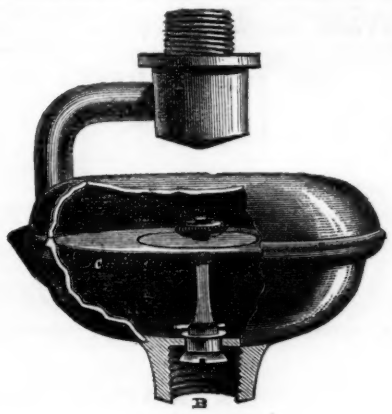

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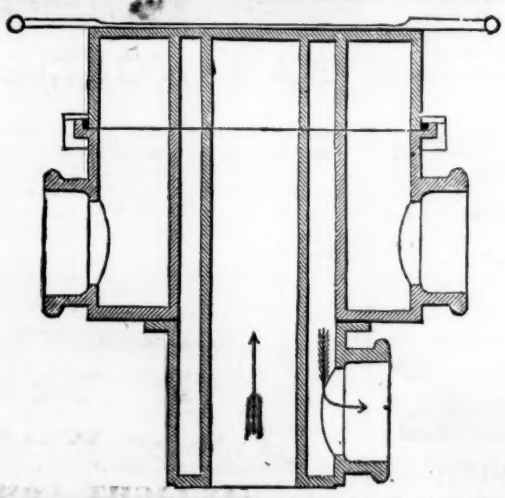

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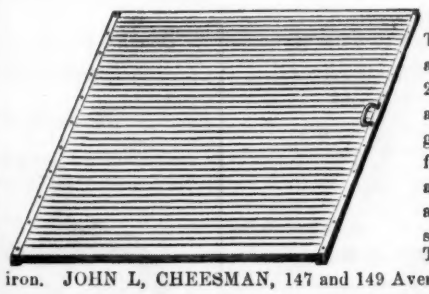

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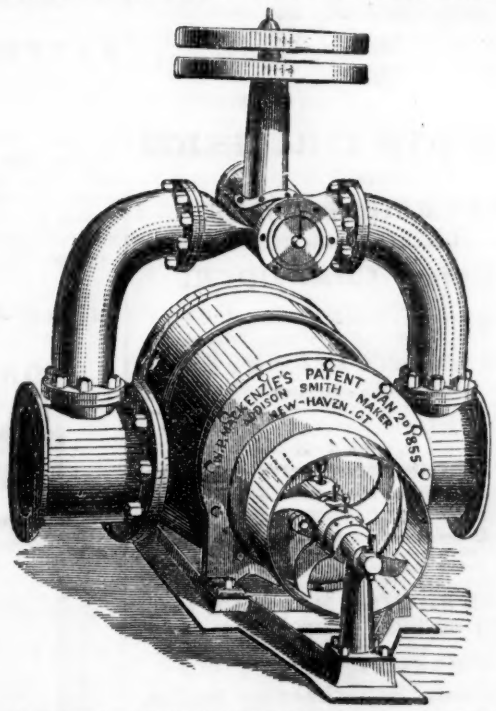

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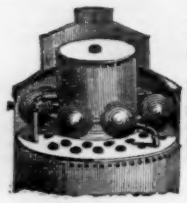

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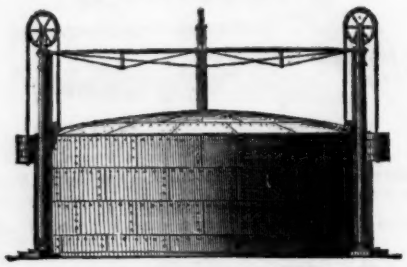

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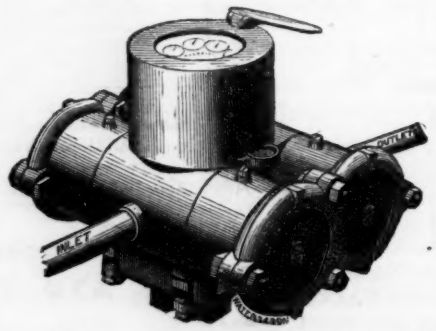

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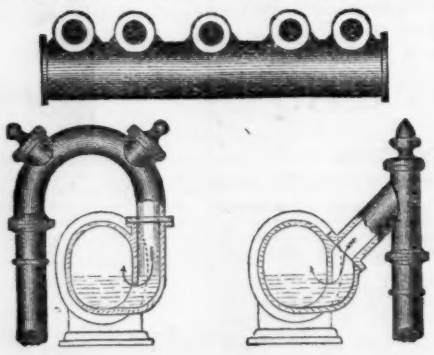

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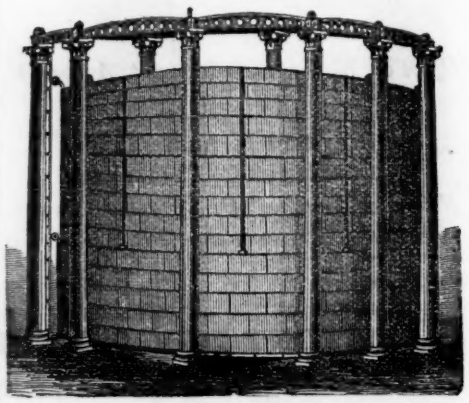

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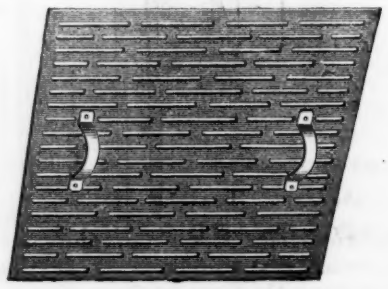

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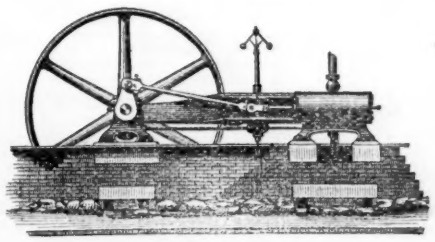

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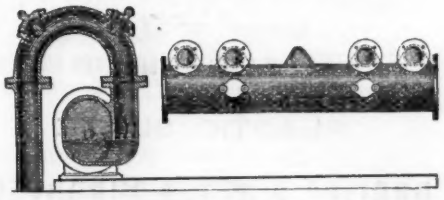

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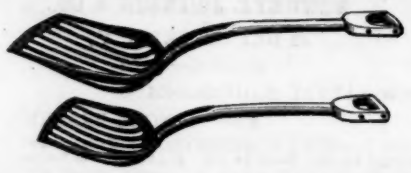

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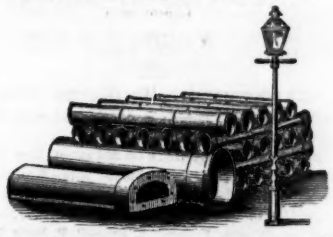

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—There are four mills in Missouri grinding barytes—one at Old Mines, one at Tunnel Station, and two in the city. This is an earthy mineral, found in large quantities in the lead field, and is used largely to adulterate white lead and other products.

—The last clean-up of the Eureka mine, at Grass Valley, Nevada county, after a run of two weeks on a comparatively poor class of rock, yielded $19,360.

—A new safety lamp has been invented in France. It is really an inclosed moderator lamp with a reservoir of compressed air to feed it. It is said to be applicable for illumination under water, but we are not told how the products of combustion escape, and fail to see how it can answer. Compressed air necessitates the use of a heavy metal reservoir, which miners, probably, will refuse to carry about.

—An inventive genius has discovered a plan for thoroughly ventilating railroad-cars, and keeping them free from cinders, by means of a shingle placed at an angle in the forward end of the window. Travelers says that the invention satisfactorily supplies the want of years, and is bound to be universally adopted.

—Dr. Vogel has introduced a new actinometer, which is so arranged as to expose sensitive paper to light under a ladder formed by layers of paper resisting in varying and regular degrees the action of the light, and each one being indicated by its particular number. The instrument is used in a kind of frame or box resembling an ordinary printing frame, but opening at the side.

—A submarine telescope has lately been tried on the river Fure, France, with great success. It is stated that the smallest pearls, and the barnacles attached to the hull of a large ship were plainly seen, and that fishes were seen passing back and forth without being disturbed.

Advertising Index.

☞ In looking for advertisements, see figures 1 to 9, within brackets, at head of advertisement pages.

GAS-BURNERS, APPARATUS ETC.

Arnold's Metallic Gas Trays—T. G. Arnold, 334 and 336 West 21st street, N. Y.. 6
American Meter Company, 512 West 22d street, New York..... 8
Automatic Gas Purifier—State Rights for sale—Wm. C. Turnbull, care of T. C. Babcock, 59 Broadway, or office of the AMERICAN GAS-LIGHT JOURNAL..... 2
Builder of Gas Works, Apparatus, Etc.—P. P. Delly, 39 Laurel street, Philadelphia..... 6
Begg's Lamp Regulator—Office Gas-Light Journal, 22 Pine st... 3
Cambridge Gas Stoves, Ranges, &c.—Gas Light Journal Offices, 8
Contractors for Gas-Works, Etc.—Murray, Baker & Walker, Fort Wayne, Ind... 2
Gas Fixtures, Etc.—Archer & Pancoast Manufacturing Co., 9, 11 and 13 Mercer street, New York..... 2
Gas Fitters' and Plumbers' Materials—McNab & Harlin, 86 John street, New York..... 3
Gas Coals—Bird, Perkins & Job, 104 Wall street, New York..... 4
Gas Engineers and Contractors—Hoy, Kennedy & Co., 111 Liberty street, New York..... 4
Gas-Burners—C. Gefrorer, 529 Commerce street, Philadelphia, Pa..... 9
Gas Meter Manufacturers—Harris & Bro., 1117 Cherry street, Philadelphia, Pa..... 8
Gas Superintendent—C. M. Cresson, 417 Walnut st., Phil., Pa.... 9
Gas Apparatus, &c.—Geo. H. Kitchen & Co., 561 Broadway.. 9
Gas Burners—Wightman Bros., 25 Kilby st., Boston, Mass..... 9
Gas Burners—T. G. Arnold, 224 and 226 West 21st st., N. Y. .. 9
Gas Burners—W. Anderson, cor Franklin & Elm sts., N. Y..... 8
Gas Works for Sale—Colonel J. A. Sabbaton, Manhattan Gas Works, N. Y.. 8
Gas Stoves—A. L. Bogart, 792 Broadway 7
Gas Fixtures, Meters, Etc., Etc.—McHenry & Carson, Cincinnati, Ohio..... 4
Gas Fixtures & Chandeliers—Alfred Bliss & Co., 95 Bleecker-st., New York..... 4
Gasometers, Etc—George Stacey & Co. Cincinnati, O..... 6
Gas-works of London—D. Van Nostraud, 192 Broadway..... 3
Gas and Kerosene Fixtures, &c.—Tocker Mfg Co , 128 William street, New York ; 117 and 119 Court street, Boston, Mass.... 3
Gas Works for sale—Superintendent, Tiffin, Ohio..... 3
Patent Gas Exhauster—Smith & Sayre, 484 Broadway 5
Purifying Trays—Jno. L Cheeseman, 147 and 149 Ave. C. N.Y.. 2
Portable Gas Works—Covell & Co., 554 Broadway, New York.. 3
Robbins' Patent Joint for Gas and Water Pipes..... 4
Stanley's Hydraulic Main, Etc.—L. F. Whiting, Boston..... ... 6

FOUNDRIES.

Brooklyn Tube Works—B T. Benton, Brooklyn..... ... 9
Columbian Iron Works—Wm. Taylor & Sons, 11, 13 and 15 Adams street, Brooklyn, N. Y... 7
Cast Iron Pipes and Fittings—B. S. Benson, 52 East Monument street, Baltimore, Md... 1
Continental Works—T. F. Rowland, Greenpoint.... 6
Erie Basin Iron Works—Elizabeth. Dwight and Van Dyke sts., South Brooklyn, N. Y 6, 7
Louisville Pipe Works—Dennis Long, Cor. 9th and Water-sts., Louisville, Ky..... 9
Manufacturing Enamelers—Nessle & Taylor, 97 Water street, Brooklyn, N. Y..... 7
National Foundry and Pipe Works—Wm. Smith, Carroll, Pike, Smallman and Wilkins streets, Pittsburgh, Pa..... 4
Oregon Iron Foundry—Herring & Floyd, 738, 740, 742 and 744 Greenwich street, New York..... 3
Pascal Iron Works—Morris, Taskar & Co., Philadelphia, Pa.....9
Southwark Foundry—Merrick & Sons, Fifth and Washington streets, Philadelphia..... ..9
Wrought Iron Pipes, etc.—Joseph Nason & Co., 61 Beekman street, New York..... 4

WATER METERS, PUMPS, ETC.

Ashcroft's Low-water Detector, 50 John street, New York..... 6
Aubin Water Meter—H. Q. Hawley, Albany, N. Y.....7, 9
Babcock & Wilcox's Stationary Steam Engines 8
Davis' Steam Superheating Boiler—Duplex Steam Boiler Mf'g Company, Long Island City, N. Y.. 9
Pat. Lead-Encased Tin Pipes—Colwells, Shaw & Willard, foot of West 27th street, N. Y..... 4
Patent Dry Centre Valve—American Meter Company, 512 West 22d street New York. 5
Steam Pumps—H. R. Worthington, 61 Beekman st. New York.. 7
Water Pipes, etc.—S. Fulton & Co. 207 North Water st Phila.... 9
Water Closets, etc.—Wm. S. Carr & Co. 149, 151, 153, 155, 157 Centre street, New York..... 4
Water and Sewerage Pipes—Am. Water and Gas Pipe Company northwest corner of Green and Bay sts., Jersey City, N. J.... 5
Worthington's Water Meters—H. R. Worthington, 61 Beekman street, New York..... 6

CLAY RETORT WORKS.

B. Kreisher, Clay Retorts, Etc., 58 Goerck street, New York.... 5
Bay State Clay Retort Works, 125, 127 Water st. Boston, Mass.. 6
Brooklyn Clay Retort Works, Van Dyke st. Brooklyn, N. Y..... 5
Jersey City Fire Brick Works.—J. H. Gautier & Co., Greene, Essex and Bergen streets, Morris Canal Basin, N. J..... 5
Laclede Fire Brick Works, 1007 North Levee, St. Louis, Mo..... 3
Mannattan Clay Retort Works, 15th st. near Av. C, New York... 5
Philadelphia Fire Brick Works, Vine and 23d sts. Philadelphia.. 5
Retorts, Pipes, &c.—R. D. Wood & Co., 400 Chestnut street, Philadelphia..... 9

MINING MACHINERY, ETC.

Broker in Mining Stocks—C. H. Smith 145 B'way, New York.... 4
Industrial Chemistry—Prof. H. Dussauce, New Lebanon, N. Y.. 2
Mining Engineer—J. H. Tiemann, 240 Pearl st. New York 4
Sodium Amalgam &c.—Prof. Wurtz, 26 Pine st., New York..... 6
School of Mines, Columbia College, East 49th st. " 2
J. S. Phillips, Mining Engineer, Wadsworth House, San Francisco, Cal..... 4

LAMPS, STOVES, PETROLEUM, ETC.

Lamps—F. H. Lovell & Co 233 Pearl street, New York..... 7
Street Lamps—J. G. Miner, Morrisania, Westchester Co., N.Y.. 2
Lamps, &c.,—Julius Ives & Co., 49 Maiden Lane, N. Y... 9

MISCELLANEOUS.

A Rare Opportunity for Investment—Offices of this Journal.... 3
Apparatus For Sale—Washington (D. C.) Gas Company..... 6
Bird Cages—Osborn Manufacturing Company, 109 Bleecker st.. 8
Cameron Coal Company—42 Broadway..... 1
Despard Coal 1
Empire S. S. Line for Savannah, Garrison & Allen, 5 Bowling Green..... 9
Empire Sewing Machine Company, 294 Bowery..... ... 6
Finkle & Lyon Sewing Machine Company, 581 Broadway..... 9
Fodell's "Book-keeping for Gas Companies"..... 2
Gas-Light Journal American and Foreign Patent Agency... ... 8
Opposition S. S. Line to California—177 West st., cor. Warren... 9
Professor Henry Wurtz—Office Gas-Light Journal..... 3
Prince's Metallic Paint—D. Sloan & Co. 115 Liberty street..... 5
Plastic Slate Roofing Co. 157 Broadway..... 8
Pianos—Raven & Bacon, 644 and 646 Broadway, N. Y..... 9
Partner Wanted—Wm. Bent, Medina, Orange County, N. Y..... 8
Platinum—Vessels, Apparatus, Sheet-wire, etc.—H. M. Rayner, 748 Broadway, N. Y..... 3
Roofing Materials—E. Van Orden & Co. 41 Liberty st..... 4
Rubber Goods—O. B. Gray, 201 Broadway..... 4
Smedberg's "Synopsis of Gas-Lighting"..... 2
Situation Wanted as Manager of a Gas Work..... 3
Steam Cooking Apparatus—Bennett, Johnson & Co., 42 Dey st., New York..... 6
Sabbaton's Patent Screening Shovels—A. T. Smithe, No. 126 Maiden Lane, New York city..... 8
Smith & Sayre Manufacturing Company, 95 Liberty street..... 5
Situation as Superintendent Wanted—Sup't Office G. L. Jour.... 2
Situation Wanted by an Engineer of many years, Experience... 6
Treatise on the Manufacture of Gas—D. Van Nostrand, 192 Broadway, New York. 8
Ventilation—Henry A. Gouge. 254 Broadway 6
Watches—T. B. Bynner 189 Broadway..... 2
Works on the Manufacture of Gas—D. Van Nostrand, 192 Broadway, New York..... 2

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